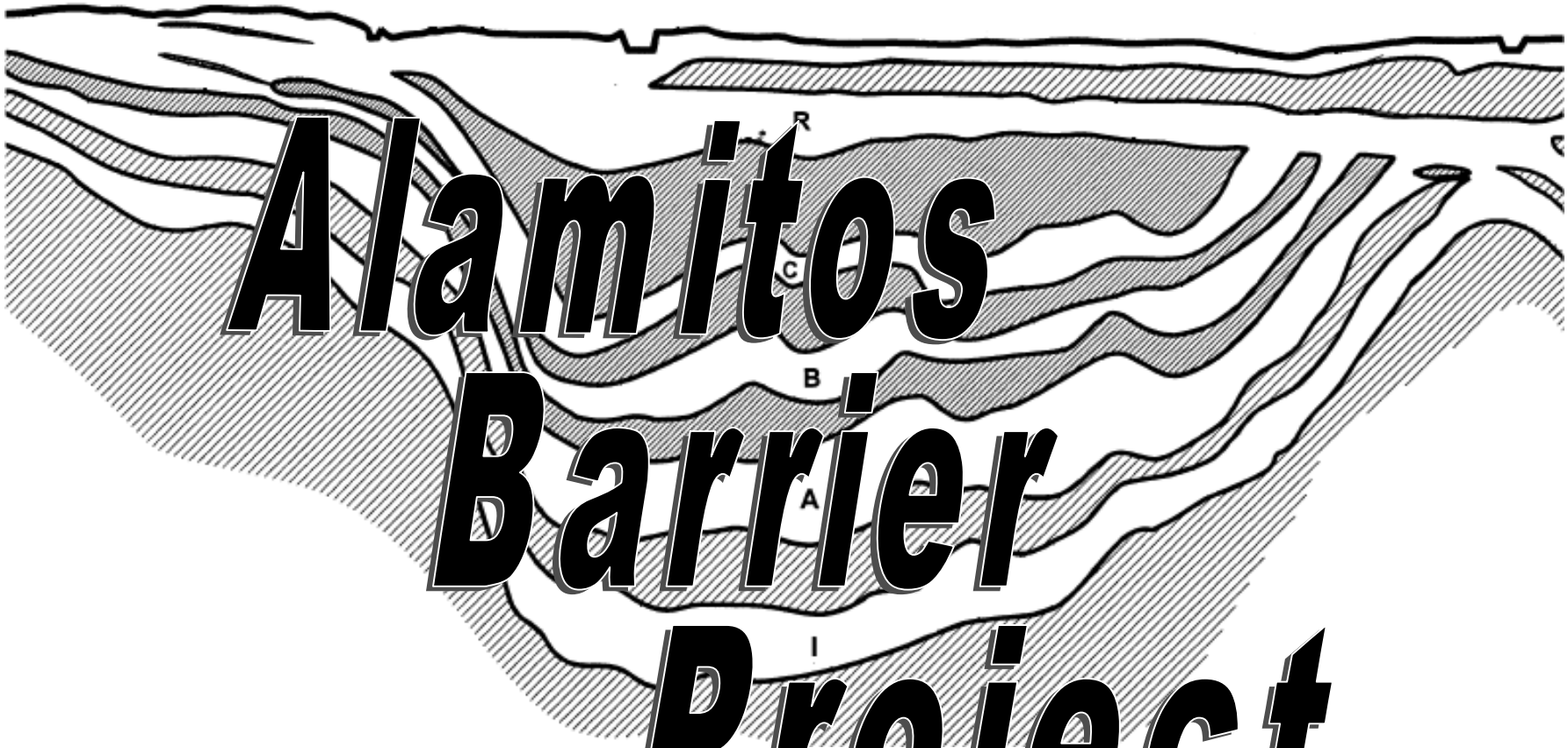

Alamitos Barrier Project

Alamitos Barrier Project

Annual report on the control of seawater intrusion

2016 - 2017

Member Agencies:

Orange County Water District

Water Replenishment District of Southern California

Long Beach Water Department

Golden State Water Company

Los Angeles County Flood Control District

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Submitted by:

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Joint Management Committee

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INTRODUCTION

The Alamitos Barrier Project (ABP) was designed and constructed to protect the groundwater supplies of the Central/Orange County Basin of the Coastal Plain from the intrusion of seawater through the Alamitos Gap area. The project facilities are located near the Los Angeles-Orange County border about two miles inland from the terminus of the San Gabriel River. The original facilities included injection wells to form a freshwater pressure ridge and extraction wells to form a saltwater trough. The freshwater pressure ridge has proven to be historically effective, whereas the saltwater trough has not. As a result, the extraction wells are currently not in operation. A map showing the supply pipeline, injection wells, extraction wells, and observation wells is shown on page A-12.1.

The County of Los Angeles Department of Public Works (Public Works) operates and maintains the ABP and its associated facilities under the direction and approval of the Joint Management Committee (JMC), acting on behalf of the Los Angeles County Flood Control District (LACFCD) and the Orange County Water District (OCWD).

This report summarizes design and construction issues, operation and maintenance activities, hydrogeologic effects, chloride concentrations, and project costs for Fiscal Year (FY) 2016-17 (i.e., July 1, 2016 through June 30, 2017).

SUMMARY

During FY 2016-17, a total of 6,060.0 acre-feet (AF) of water was injected into the ABP (an average rate of 8.4 cubic feet per second). Of that total, OCWD purchased 1,165.1 acre-feet (19 percent) and the Water Replenishment District of Southern California (WRD) purchased 4,894.9 acre-feet (81 percent). This total injected amount was 747 AF less than FY 2015-16, and was slightly lower than the average injection of 6,089 AF for the previous five fiscal years. However, even though a significant number of ABP injection wells were offline during this reporting period due to OCWD's ABP Unit 14 Injection and Observation Wells Project (ABP Unit 14 Project), injection rates at the remaining wells in service continued to be higher than average to counteract lower groundwater elevations, which are most likely the result of historic drought conditions. No major shutdowns have occurred since FY 2006-07. All minor shutdowns for FY 2016-17 are detailed in Appendix A-18.

The total costs associated with the ABP in FY 2016-17 are summarized below:

- Total Cost in FY 2016-17: $8,446,275
  - Injection Water costs: $6,794,079 (OCWD: $1,271,066; WRD: $5,523,014)
  - Total Operations and Maintenance Costs: $1,652,196
    - Injection-related costs: $1,650,686 (OCWD: $307,521; LACFCD: $1,343,165)
      - Equivalent cost per AF of water injected: $272.39
    - Extraction-related costs: $1,510 (LACFCD only)
  - Liability Insurance cost: $75,588 (OCWD: $37,794; LACFCD: $37,794)

Overall, groundwater levels showed little change from the previous year with the exception of the east leg, where localized decreases related to operational activities due to OCWD's ABP Unit 14 Project were observed. West of the San Gabriel River, chloride concentrations generally decreased with the exception of various localized increases in the C zone north of the west leg. East of the San Gabriel River, widespread high chloride concentrations were still present and increased in most cases; some wells with

exceptionally high chlorides showed remarkable decreases while remaining quite elevated. This is most likely the result of operational changes due to OCWD's ABP Unit 14 Project. Detailed analyses of the reporting period's groundwater elevations and chloride concentrations are provided in the "Hydrogeologic Effects" and "Chlorides" sections below.

It is imperative that the barrier operate consistently and continuously to best prevent seawater intrusion. The JMC will continue to ensure that the ABP is operated and maintained efficiently, economically, and continuously protects the region's groundwater supplies. The inclusion of additional wells as part of the ABP Unit 14 Project will significantly aide in the protection of the region's groundwater resources.

PROJECTS AND STUDIES

Capital improvement projects and studies over this reporting period are briefly summarized below. The general location of each project is identified on the map in Appendix A-12.2 and further project details are included in Appendix A-17.

ABP Telemetry Upgrade

This project is funded by LACFCD. LACFCD hired Tetra Tech to perform a telemetry system design, which consists of replacing the existing Geomation system with a state-of-the-art telemetry system that can be integrated with the existing Seawater Barrier Telemetry system. The ABP Telemetry Upgrade will also incorporate signals from injection well 33U3 which is not currently on telemetry. This project will help improve the overall efficiency of ABP operations by providing real-time data, including flow, pressure and vault flooded status. Construction began in March of 2017 and is scheduled to be complete in Fall 2017.

ABP Unit 14 Injection and Observation Wells

This project is jointly funded by OCWD and LACFCD and managed by OCWD. It consists of 17 new clustered injection wells, four nested observation wells and two shallow piezometers along the east leg of the ABP. Two injection well clusters and one nested observation well are proposed to be installed between points B and C. These new injection wells will provide additional capacity to maintain protective elevations along the east leg of the ABP. The observation wells will fill data gaps in each of the aquifer zones and improve injection operations. OCWD re-advertised the project in August 2015 and awarded the contract for Phase 1, which includes the construction and equipping of injection and monitoring wells. Phase 1 construction continued during this reporting period and concluded in June 2017. Phase 2, which involves connecting the injection wells to the ABP pipeline, construction of vaults, and installation of telemetry equipment, is scheduled to start in October 2017.

Destruction of ABP Monitoring Wells

LACFCD utilized Flood Maintenance Division personnel and equipment to destroy select monitoring wells that were identified as being in “poor condition” through LACFCD’s routine observation well cleanout program (see Maintenance on pg. 9). Wells were destroyed by the overdrilling technique using a hollow-stem auger. This project included destruction of the following LACFCD monitoring wells: 33T13(R) and 34D0.1(R).

INJECTION OPERATIONS

The total amount of water injected into the ABP during FY 2016-17 was 6,060 AF. Of this total, approximately 19 percent (1,165.1 AF) was recycled water and 81 percent (4,894.9 AF) was imported water. The maximum monthly injection during this reporting period was 595.2 AF (481.3 AF imported and 113.9 AF reclaimed) which occurred in July 2016. The minimum monthly injection of 384.7 AF (209.5 AF imported and 175.2 AF reclaimed) occurred in June 2017 due to higher groundwater levels basin-wide in conjunction with decreased injection along the Los Alamitos Channel as part of OCWD's ABP Unit 14 Project.

The percentage of recycled injection increased considerably from the previous year primarily due to more consistent operation of the Leo J. Vander Lans Advanced Water Treatment Facility (AWTF) since completion of the 2014 plant expansion project. The AWTF continued to run intermittently between 3 and 4 million gallons per day (MGD).

The injection volumes and costs for FY 2015-16 and FY 2016-17 are shown in Table 1. The representative unit costs included in Table 1 for imported and reclaimed water were calculated by WRD. Table 1 shows that the volume of water injected at the ABP during FY 2016-17 decreased by 11 percent from the previous year, and is slightly lower than the average injection of 6,089 AF for the previous five years. However, the amount of water injected at the ABP in FY 2016-17 is considerably higher than average volumes injected annually over the past thirty years (5,491 AF).

All ABP shutdowns from FY 2016-17 are summarized in Appendix A-18. There were no major shutdowns during this reporting period.

TABLE 1. INJECTION OPERATIONS

	Imported Water Injections			Recycled Water Injections			Total Injections		
	FY15-16	FY16-17	Percent Change From Previous Year	FY15-16	FY16-17	Percent Change From Previous Year	FY15-16	FY16-17	Percent Change From Previous Year
	VOLUME OF WATER INJECTED IN ACRE-FEET								
OCWD[1]	1,946.5	781.3	-59.9	452.2	383.8	-15.1	2,398.7	1,165.1	-51.4
WRD[2]	3,551.9	3,215.3	-9.5	857.1	1,679.6	96.0	4,409.0	4,894.9	11.0
TOTAL	5,498.4	3,996.6	-27.3	1,309.3	2,063.4	57.6	6,807.7	6,060.0	-11.0
	UNIT COST OF WATER PER ACRE-FEET[3]								
JULY - DEC	$1,057.74	$1,090.95	3.1	$1,057.74	$1,090.95	3.1			
JAN - JUN	$1,087.95	$1,128.32	3.7	$1,087.95	$1,128.32	3.7			
	COST OF WATER PURCHASED								
OCWD[1]	$2,058,891	$852,359	-58.6	$478,310	$418,707	-12.5	$2,537,201	$1,271,066	-49.9
WRD[2]	$3,864,290	$3,627,887	-6.1	$932,482	$1,895,126	103.2	$4,796,772	$5,523,014	15.1
TOTAL	$5,923,181	$4,480,247	-24.4	$1,410,792	$2,313,833	64.0	$7,333,972	$6,794,079	-7.4
	AVERAGE INJECTION RATE IN CFS								
OCWD[1]	2.7	1.1	-59.9	0.6	0.5	-15.1	3.3	1.6	-51.4
WRD[2]	4.9	4.4	-9.5	1.2	2.3	96.0	6.1	6.8	11.0
TOTAL	7.6	5.5	-27.3	1.8	2.9	57.6	9.4	8.4	-11.0

[1] Orange County Water District (OWCD)

[2] Water Replenishment District (WRD)

[3] The Unit Cost of ***Imported Water*** Per Acre-Feet is the sum of the Metropolitan Water District's wholesale rate at LB-07A (managed by Long Beach Water Department) , the $5 Administrative Surcharge, Readiness-To-Serve (RTS) costs, and Capacity costs (using total volume plus penalties). This amount is greater than what is shown on monthly invoices because Capacity costs are not typically known or accounted for at the time of those invoices. Based on the agreement between the OCWD and the WRD, the representative Unit Cost of ***Recycled Water*** Per Acre-Feet is equal to that of the imported water and is shown in the calculations by the WRD.

FIGURE 1 - MONTHLY AMOUNT OF WATER INJECTED

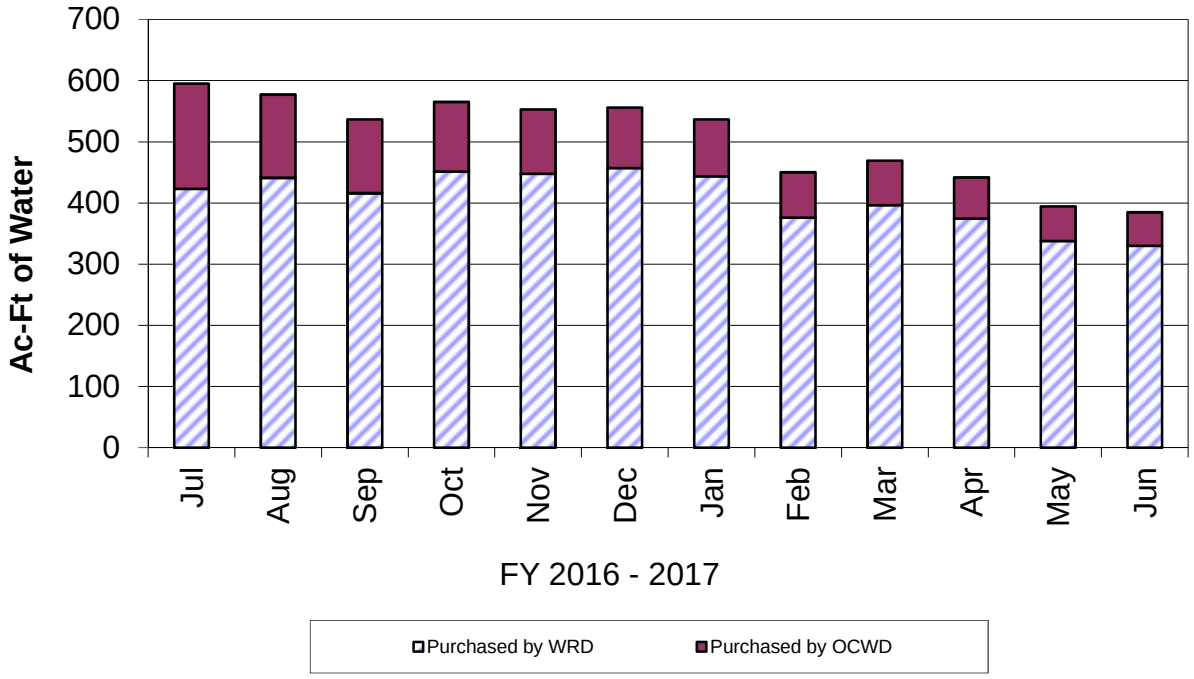
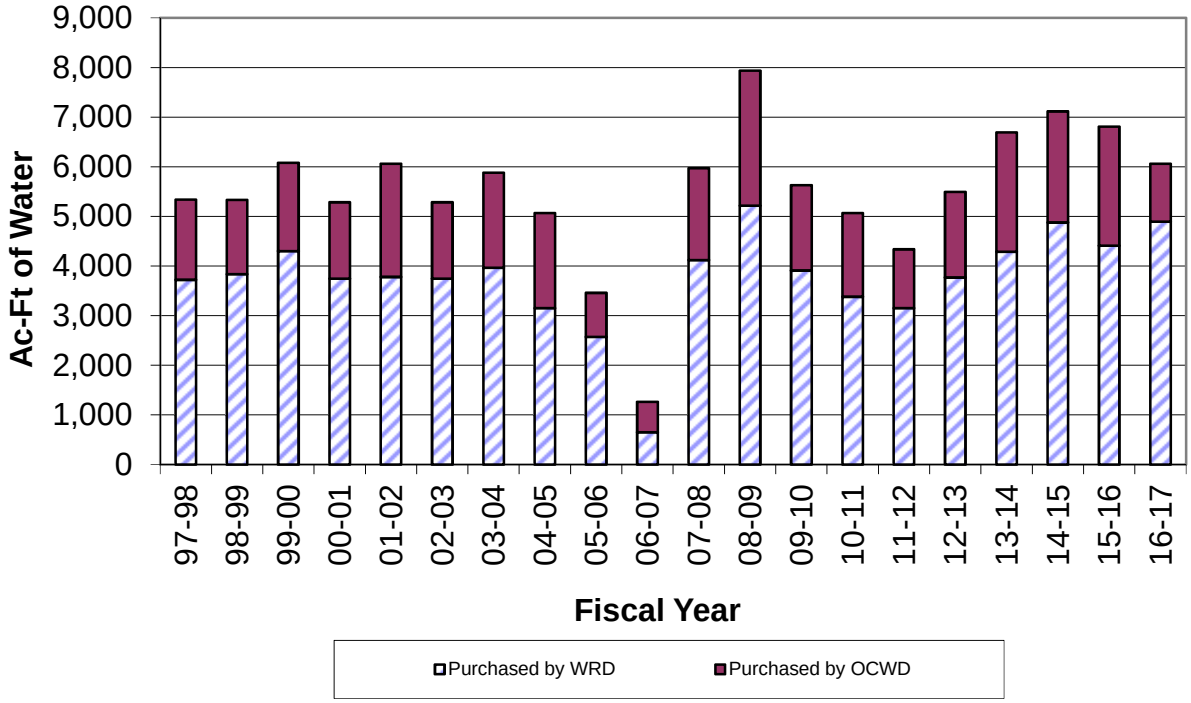


FIGURE 2 - ANNUAL AMOUNT OF WATER INJECTED



MAINTENANCE

Typical well maintenance at the ABP includes observation well cleanouts and injection well redevelopments. The purpose of injection well redevelopments is to remove accumulated sediments and microbiological build-up within the well casings to restore each well's ability to operate at its maximum injection capacity. Each of the 41 injection well casings are routinely redeveloped once every two years. During FY 2016-17, Public Works completed redevelopment activities at the following 17 well casings[1]: 33G, 33J, 33L, 33N, 33Q, 33Q1, 34E(I), 34E(C,B), 34F(A), 34F(I), 34H(I), 34Z, 35F, and 35G.

Figure 3 depicts the operating status of each injection and extraction well during FY 2016-17 and demonstrates that the ABP was in operation throughout the entire reporting period. There were multiple individual ABP well shutdowns as explained in Appendix A-18. Most of these shutdowns are primarily the result of changes in ABP operation to accommodate the drilling and construction of new ABP injection wells along the Alamitos Channel, however, injection well 33S1 operated at a limited flow due to surface leakage, and injection well 34H(A) continues to remain offline due to a hole in the casing.

Injection well 33W suffered from surface leakage intermittently since being struck by an automobile in 2007. A video investigation conducted by LACFCD in August 2016 identified a pinhole leak less than 100' from the surface. In addition, the 2012 Condition Assessment performed by CH2MHill determined that well 33W has a poor condition annular seal. To prevent this leakage, a packer was installed just above the perforations to isolate the injection zone, and the well has been operating at normal injection rates and pressures since packer installation in June 2016.

During redevelopment of injection well 34H(I) excessive fill was observed. Video inspection revealed a hole near the top of the perforations at 403'. Since this well has a 6" casing, a sleeve cannot be installed to prevent infill. The well was re-assembled and

[1] The capital letters in parenthesis represent the aquifer(s) associated with that particular injection well casing. For example, (A) = A Zone aquifer, (A,I) = A and I Zone aquifers, and so forth.

placed back in service. It should be noted that injection well 34H(A) has already been offline since Spring 2015 because it also has a hole in the perforations that is not repairable.

FIGURE 3 - ABP INJECTION AND EXTRACTION WELL STATUS FY16-17

Well No.	2016																								2017																			
	JUL				AUG				SEP				OCT				NOV				DEC				JAN				FEB				MAR				APR				MAY				JUN			
33G (A,I)								R	D																																			
33J (A,I)										D		R																																
33L (A,I)											D	R	D																															
33N (A,I)						R	R																																				
33Q (A,I)					R																																						
33Q1 (C,B)		D	R	R	D																																						
33S (A,I)	D	D	D																																								
33S1 (C,B)	R	D	D	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
33T (A,I)																																												
33U (A,I)																																			O									
33U3 (C,B)																																												
33V (A,I)																																												
33W (C,B,A,I)	H	H	H	H	H	H	H																																				
33X (C,B,A,I)																																								O			
33Y (C,B,A,I)																																												
33Z (C,B,A,I)																																												
33Z2 (A)																																												
33Z2 (I)																																												
34D (C,B,A,I)																																												
34E (C,B)																																									D	R	R	D	
34E (I)																																									D	R	R	D	
34F (A)																																							D	R	D				
34F (I)																																								R	D				
34G (A)																																												
34G2 (C,B)					O	O	O		O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O									
34G2 (I)																																												
34H (A)	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
34H (I)																																										D	D	
34J (A)									O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O										
34J (I)									O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O										
34L (C,B,A,I)																																												D
34S (A)													O	O	O		O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
34S (I)													O	O	O		O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
34S (C,B)													O	O	O		O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
34V (A)																																			O	O	O	O	O	O	O	O	O	O	O	O
34V (I)																																			O	O	O	O	O	O	O	O	O	O	O	O
34V (C,B)																																			O	O	O	O	O	O	O	O	O	O	O	O
34Z (I)	O	O	O	O				O																											O	R	D	D							
35F (I)	O	O	O	O				O																												D	R	D	D						
35G (A,I)																																					D	R	R	D						
35H1 (A)																																													
35H1 (I)																																													
35H2 (A)																																													
33V'15P	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
34H'17P	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
34H'18P	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
34S'22P	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

*Extraction Well

[ ] - Well in Operation	H - Header Repair	P - Pressure Exceedance	U - Under Construction	I - Intermittent shutdown
C - Casing Repair	M - Misc. Repair	R - Redevelopment	W - Water Quality Sampling	
D - Disassembled	N - Not Needed	S - Surface Leakage (operating with reduced flowrate)	X - Waiting for Repair	
G - Grouted	O - Other Circumstances	I - Intermittent shutdown (operated part of the week)	B - Barrier Shutdown	

HYDROGEOLOGIC EFFECTS

Figures 4 through 8 (pp. 12-16) show the average monthly groundwater elevation relative to the average groundwater elevation of the 10 preceding years (FY 2006-07 to FY 2015-16) in the vicinity of the barrier alignment in the R, C, B, A, and I Zones, respectively. Two graphs were created for each aquifer to account for changes in groundwater elevation trends along two portions of the barrier alignment: wells west of the San Gabriel River and wells east of the San Gabriel River. It is important to note that the 10-year average does not represent a groundwater elevation goal nor does it specifically reflect barrier performance, but is simply included for comparison purposes. The graph includes all available semi-monthly, monthly, semi-annual, and annual data for wells within the barrier alignment and landward for approximately 2,000 feet from the barrier. As a result, semi-monthly values are "weighted" more heavily than the annuals in the calculation of the monthly average, and the months of September and March consistently have lower values than preceding and succeeding months since semi-annual and annual water levels are measured during these months.

As shown in the graphs, groundwater elevations during FY 2016-17 were typically at or above historical averages west of the San Gabriel River for most of the reporting period. This was likely due to relatively higher basin levels compared to values obtained over the preceding five year dry period. However, groundwater levels were below historical averages east of the San Gabriel River during FY 2016-17, most likely the result of operational changes due to OCWD's ABP Unit 14 Project combined with drought conditions in the Summer and Fall of 2016. In general, all the figures show the expected seasonal trends of higher groundwater elevations in the winter months (decreased pumping) and lower groundwater elevations in the summer months (increased pumping).

FIGURE 4a RECENT ZONE WEST OF THE SAN GABRIEL RIVER

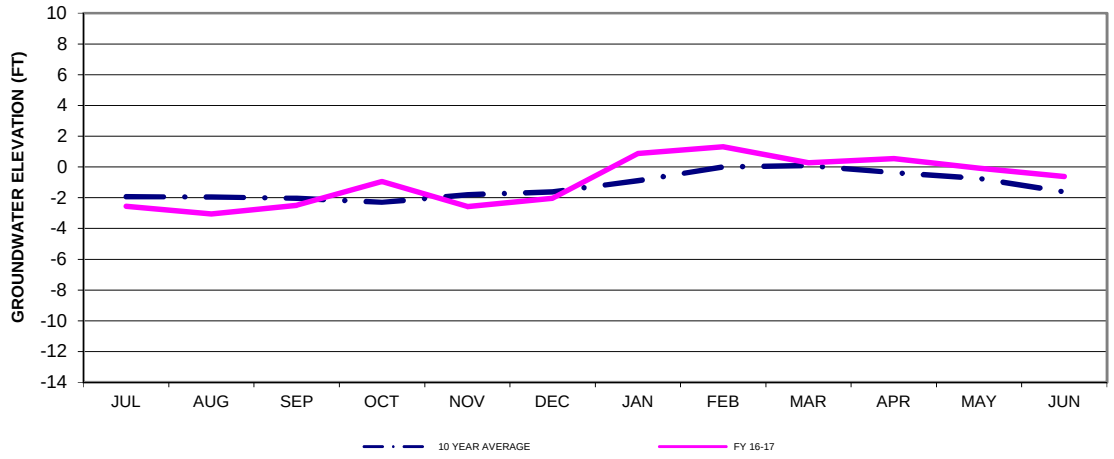


FIGURE 4b RECENT ZONE EAST OF THE SAN GABRIEL RIVER

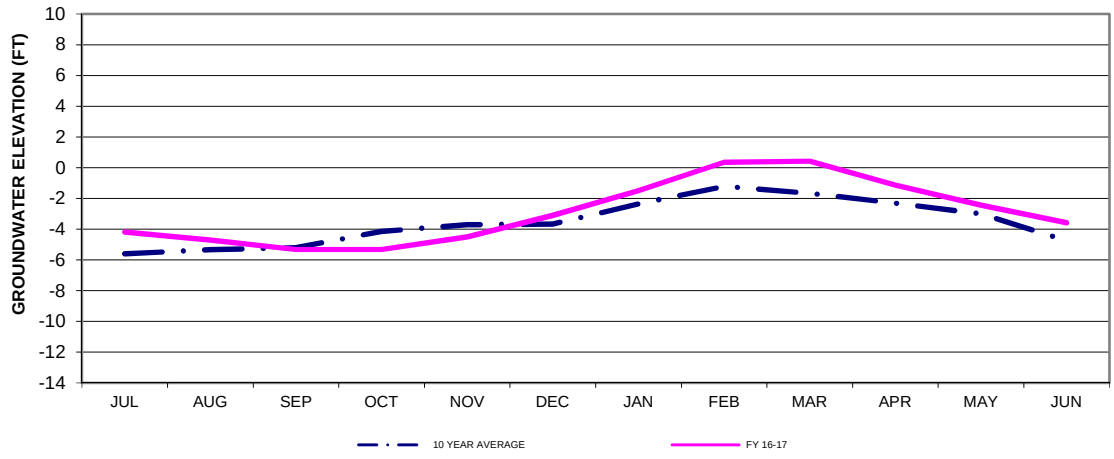


FIGURE 5a C-ZONE WEST OF THE SAN GABRIEL RIVER

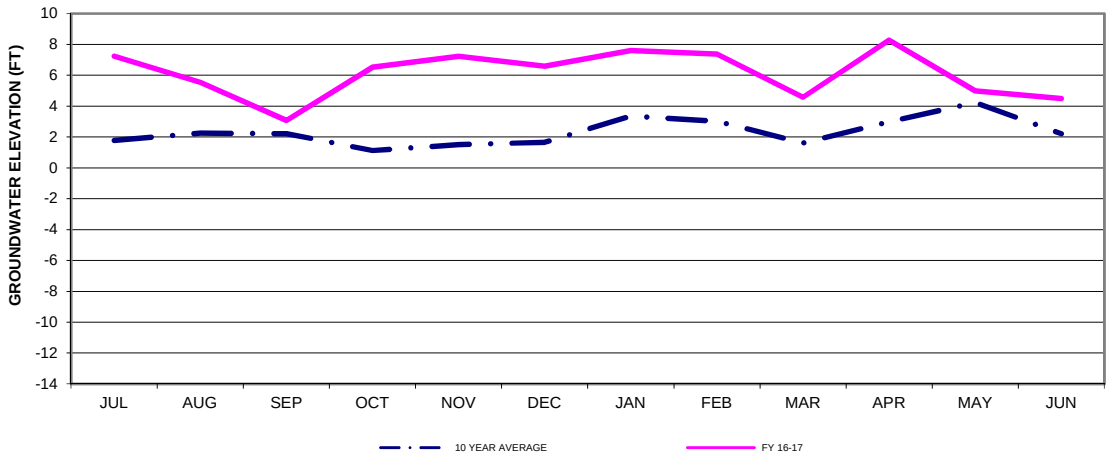


FIGURE 5b C-ZONE EAST OF THE SAN GABRIEL RIVER

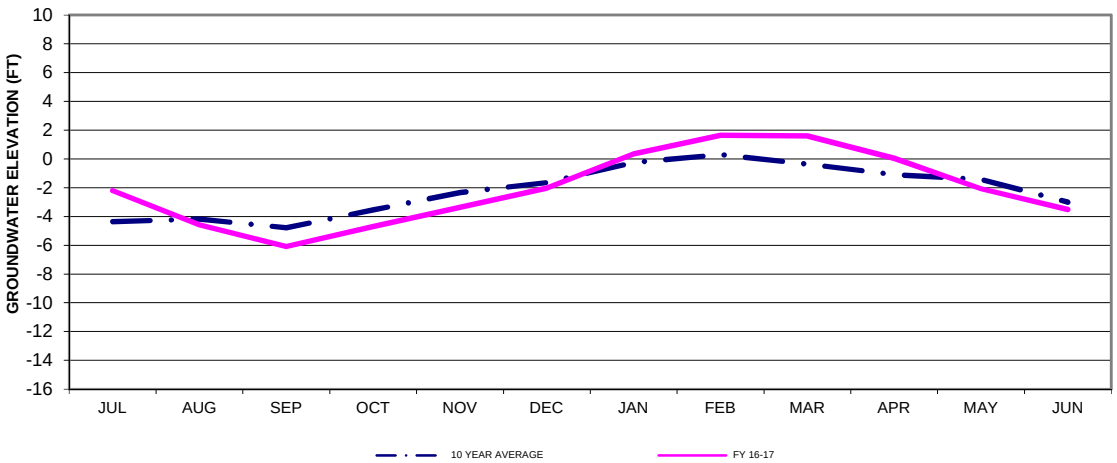


FIGURE 6a B-ZONE WEST OF THE SAN GABRIEL RIVER

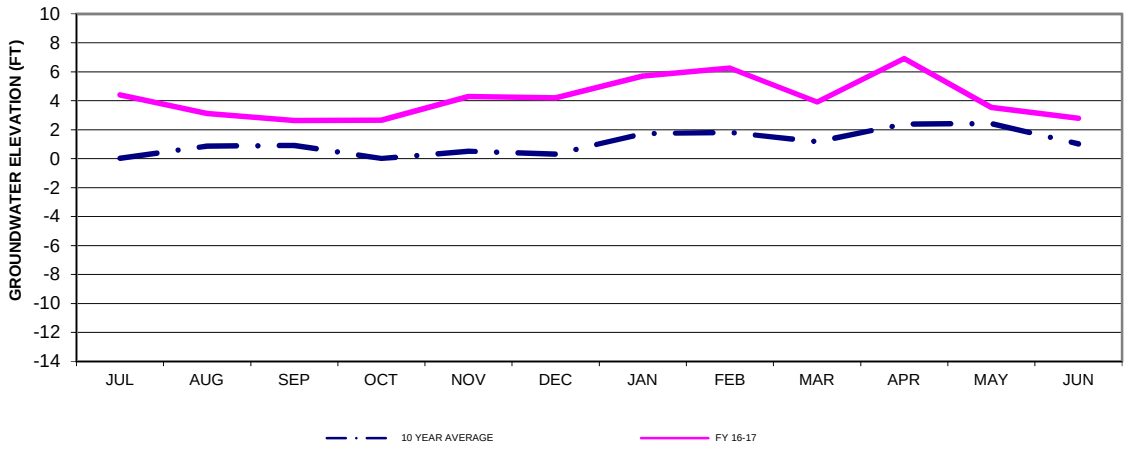


FIGURE 6b B-ZONE EAST OF THE SAN GABRIEL RIVER

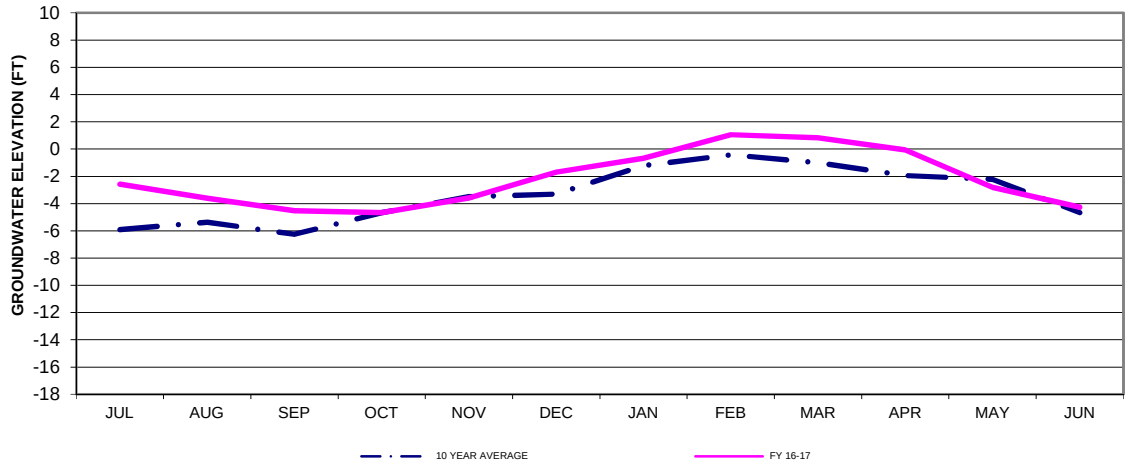


FIGURE 7a A-ZONE WEST OF THE SAN GABRIEL RIVER

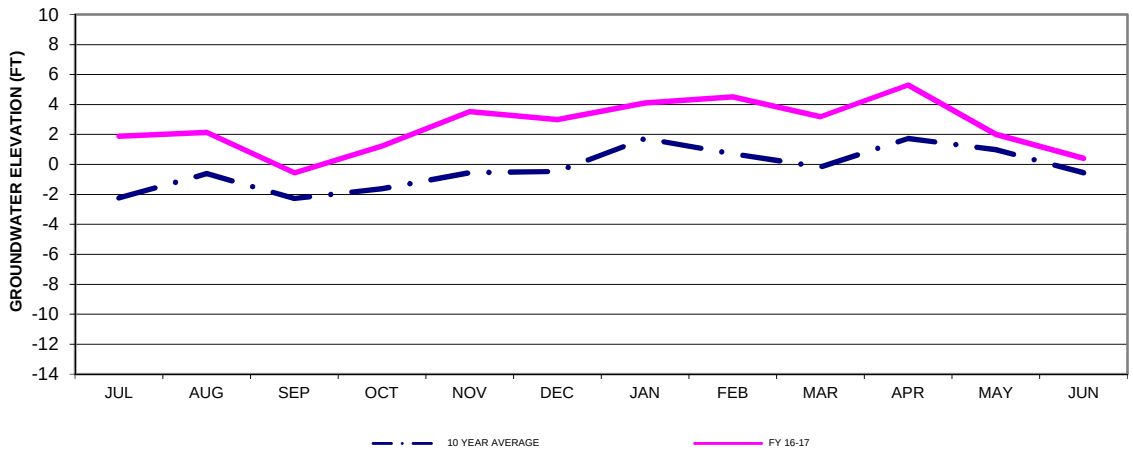


FIGURE 7b A-ZONE EAST OF THE SAN GABRIEL RIVER

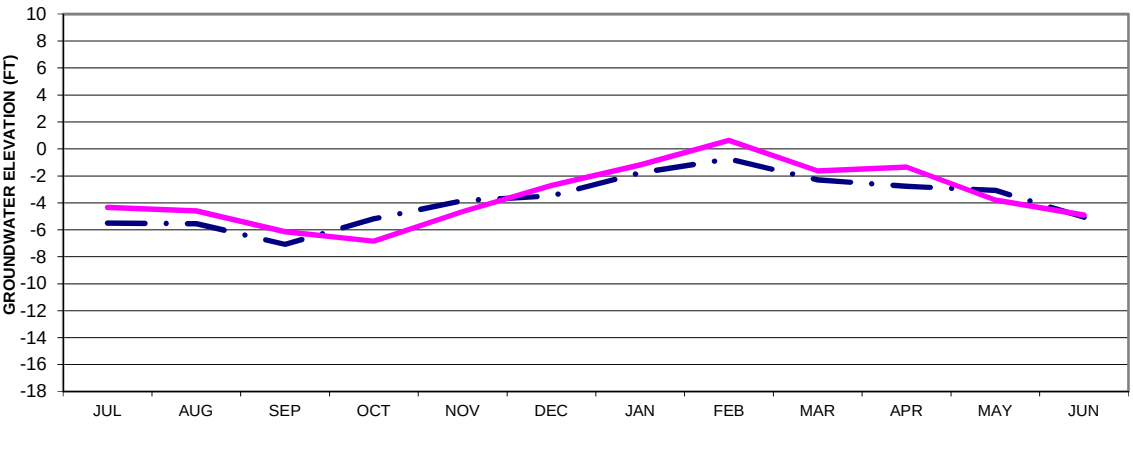


FIGURE 8a I-ZONE WEST OF THE SAN GABRIEL RIVER

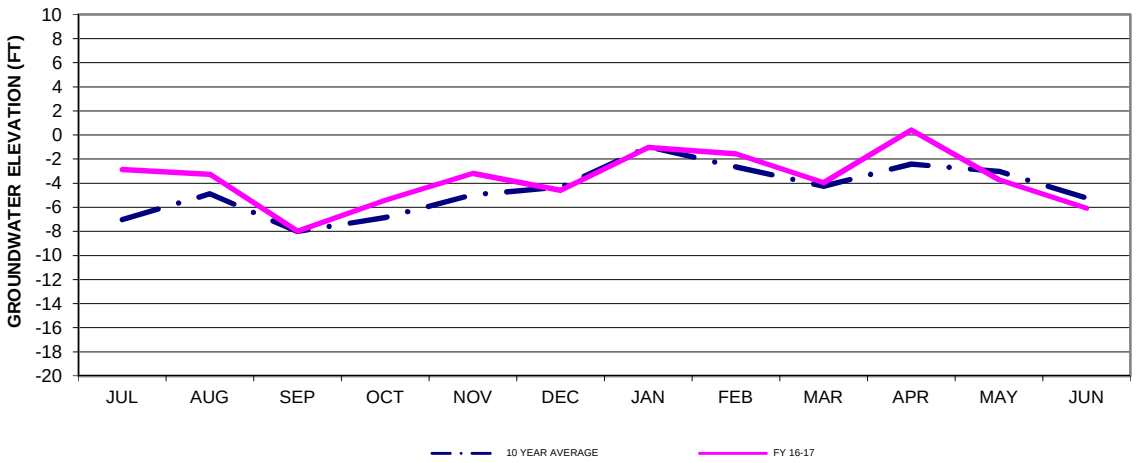
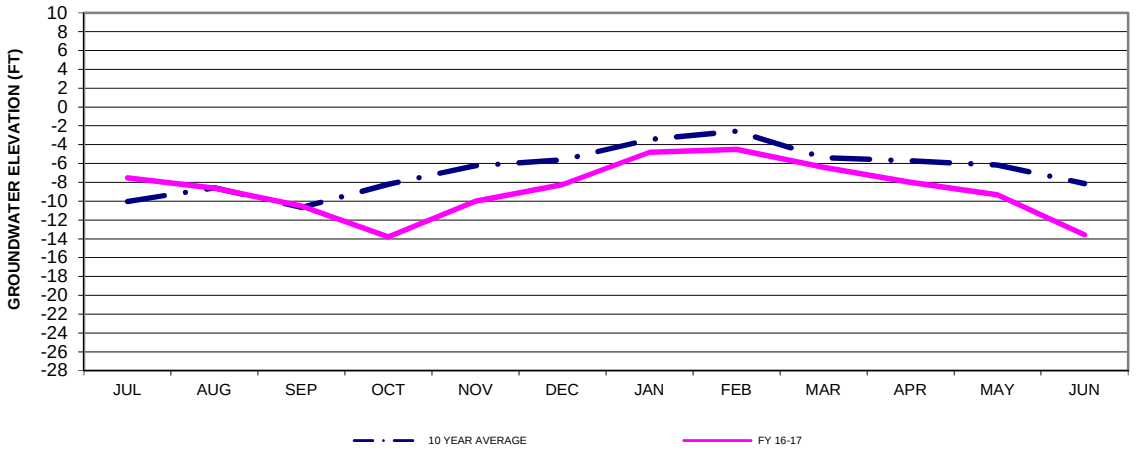


FIGURE 8b I-ZONE EAST OF THE SAN GABRIEL RIVER



Groundwater elevation contours for the R, C, B, A, and I Zones have been prepared from data collected in Spring 2017 and are included in Appendix A-1.1, 2.1, 3.1, 4.1, and 5.1. In general, the contours show that the groundwater levels were the highest near the barrier alignment, and typically decrease moving landward. The general shapes of each contour are similar to the previous year and some similar groundwater mounds are seen around certain injection wells. Areas historically having higher groundwater elevations in the C and B zones, especially near the bend at the San Gabriel River, continue to have higher groundwater elevations than their surroundings. The groundwater levels along the east leg of the barrier show very large decreases from the previous year, which is most likely the result of many injection wells in vicinity being offline to aid OCWD's ABP Unit 14 Project. Other areas of historically elevated groundwater levels (e.g., near 33XY and 33YZ) remained relatively constant when compared to the same time last year. This is likely due to the west leg of the barrier remaining in full operation during the entire reporting period.

Contours of changes in groundwater elevations for the R, C, B, A, and I Zones between Spring 2016 and Spring 2017 are shown in A-1.2, 2.2, 3.2, 4.2, and 5.2. The data set is based on available data from Spring 2017, which was then subtracted from the corresponding and available data from Spring 2016 (shown in A-1.3, 2.3, 3.3, 4.3, and 5.3). These contours clearly identify increases and decreases in groundwater elevations from one reporting period to the next. In general, most areas saw very little changes in groundwater elevation. Below is a brief summary and discussion of each aquifer zone:

- <u>R Zone:</u>
    - Groundwater elevations remained consistent in the vicinity of the ABP, with significant increases landward of the barrier.
    - Groundwater elevations increased about 1 foot along the barrier alignment between the San Gabriel River and the Los Alamitos Channel, and decreased over 3 feet in the vicinity of the east leg of the barrier.
- <u>C Zone:</u>
    - Groundwater elevations increased between 1 and 2 feet between Los

Cerritos Channel and San Gabriel River.

  - Groundwater elevations decreased between 2 feet and 4 feet along the east leg of the barrier adjacent to Los Alamitos Channel due to 34S and 34V being offline for OCWD's ABP Unit 14 Project, and slightly increased east of the barrier into Seal Beach.

- B Zone:
  - Groundwater levels decreased along the east leg due to injection wells being off for OCWD's ABP Unit 14 Project.
  - Groundwater levels increased between 1 and 2 feet landward of the barrier's west leg, and also in the vicinity of the furthest extent of the barrier's east leg.
  - Between the Los Cerritos Channel and San Gabriel River, groundwater levels increased between 1 and 2 feet in the vicinity of the barrier.
- A Zone:
  - Groundwater elevations remained constant or decreased slightly along both the west leg of the barrier and the furthest extent of the east leg of the barrier.
  - Groundwater elevations increased between Los Cerritos Channel and San Gabriel River, with localized increases up to 7 feet (e.g. 33Z'1).
- I Zone:
  - Groundwater elevations decreased in the vicinity of Los Cerritos Channel, primarily due to operational changes from the previous year.
  - Groundwater elevations decreased up to over 10 feet along the northern portion of Los Alamitos Channel (e.g. 34JL) due to OCWD's ABP Unit 14 Project.

Graphs showing the average, maximum and minimum groundwater elevations at each internodal observation well throughout FY 2016-17 are included in Appendix A-13 through A-16. As shown in the graphs, the average groundwater elevation was below the protective elevation at many wells along the barrier during FY 2016-17. However, areas of high chloride concentrations did not necessarily correlate with areas where the average

elevations were below the protective elevation. A comparison of FY 2016-17 graphs with FY 2015-16 graphs indicate that average elevations increased slightly along the west leg in all zones, and decreased significantly along the east leg. This is most likely due to operational changes related to OCWD's ABP Unit 14 Project, which is attempting to address the limited injection capacity in this part of the barrier.

CHLORIDES

Figures 9a through 13b (pp. 21-25) show the historical chloride concentrations in each individual aquifer zone. The graphs plot the average of every maximum value measured at each observation well during each sampling event within the target area throughout FY 2016-17. The data includes all available information from the annual and semi-annual chloride sampling events for wells within the barrier alignment and landward for approximately 2,000 feet from the barrier. As a result, the semi-annual values are "weighted" more heavily than the annuals in the calculation of the annual average. Two sets of graphs were created for each aquifer to account for changes in chloride concentration trends in the areas to the west and east of the San Gabriel River, respectively. In each figure, the average of the maximum chloride concentrations per well per event over the last 10 fiscal years (including FY 16-17) is shown with respect to the freshwater condition (250 mg/L).

Figure 9a: R-Zone Chloride West of San Gabriel River

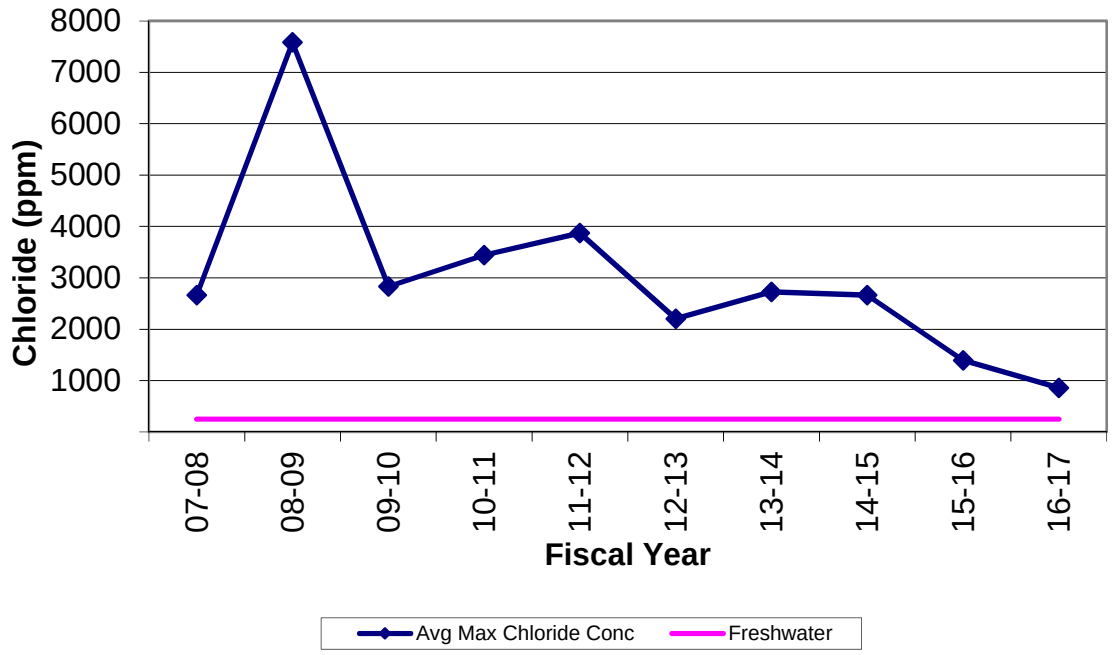


Figure 9b: R-Zone Chloride East of San Gabriel River

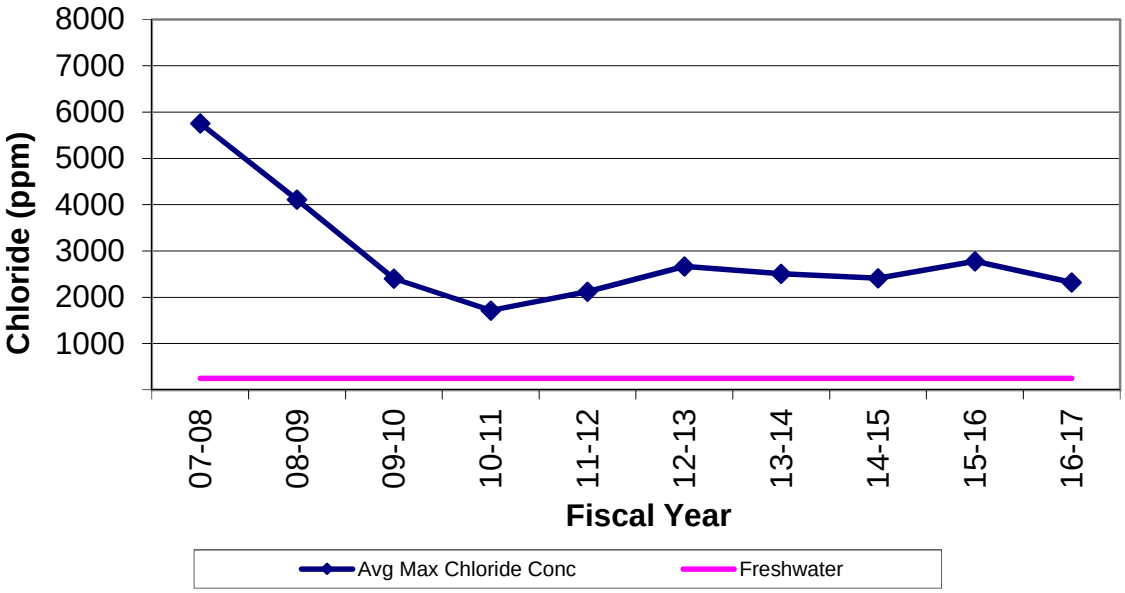


Figure 10a: C-Zone Chloride West of San Gabriel River

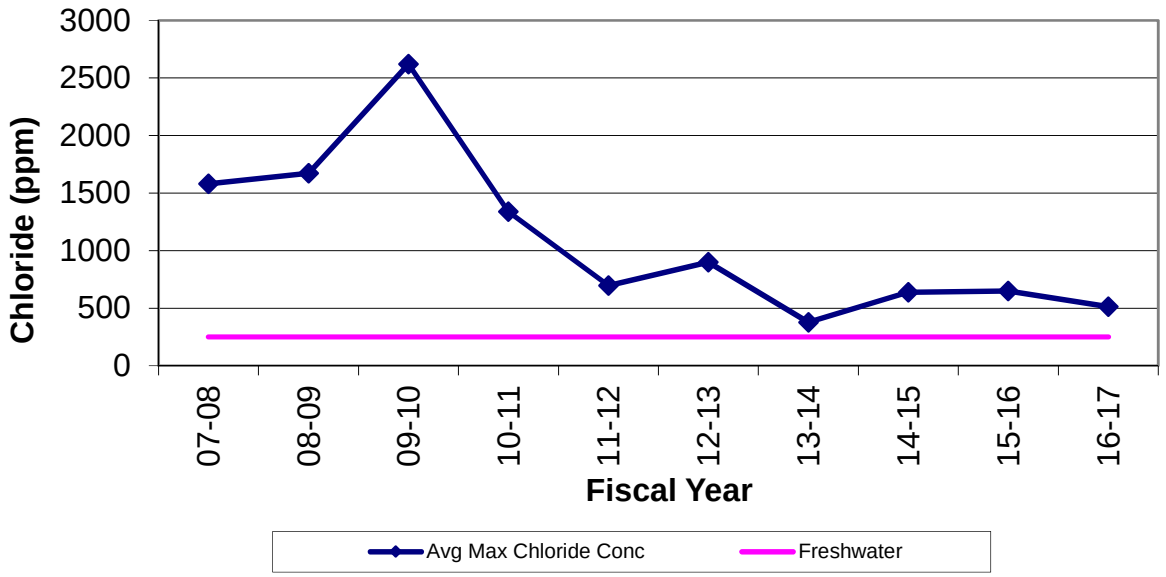


Figure 10b: C-Zone Chloride East of San Gabriel River

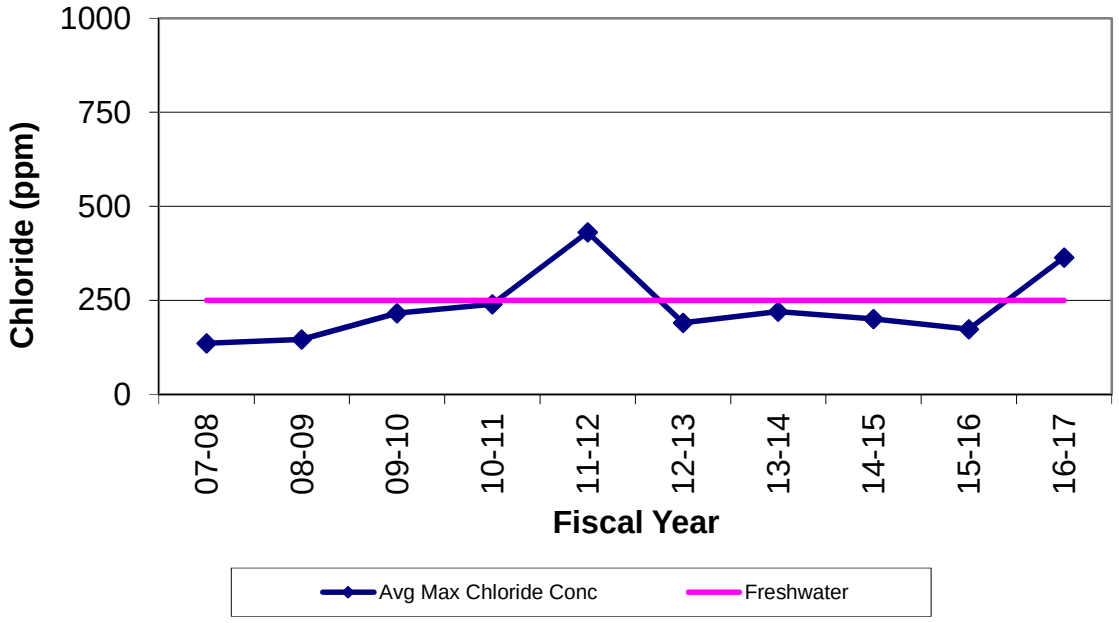


Figure 11a: B-Zone Chloride West of San Gabriel River

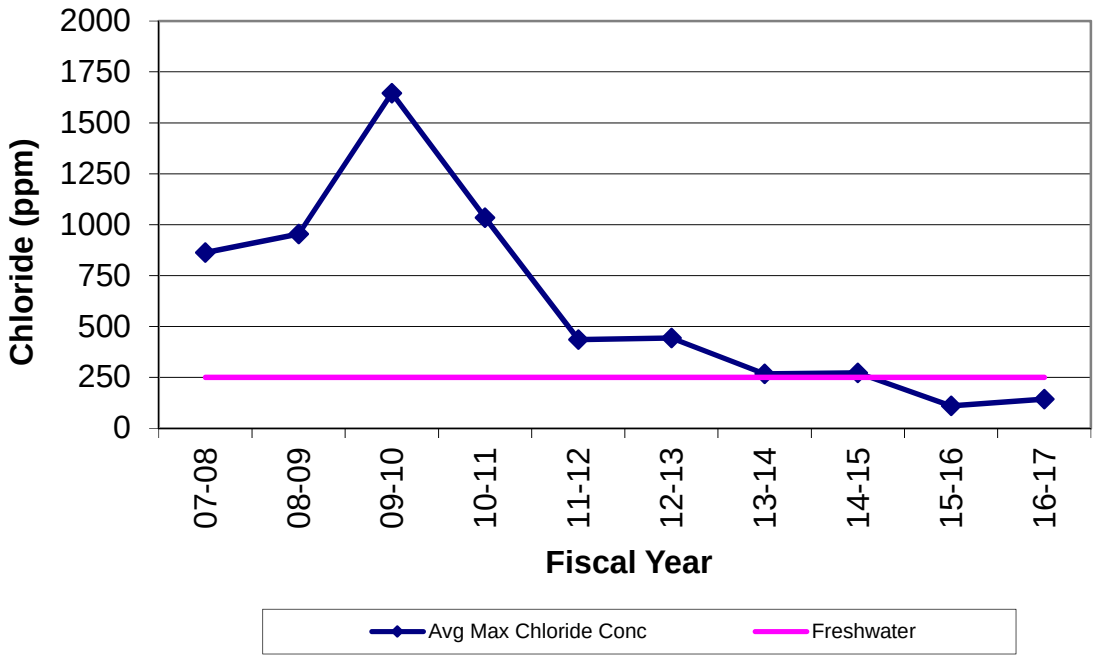
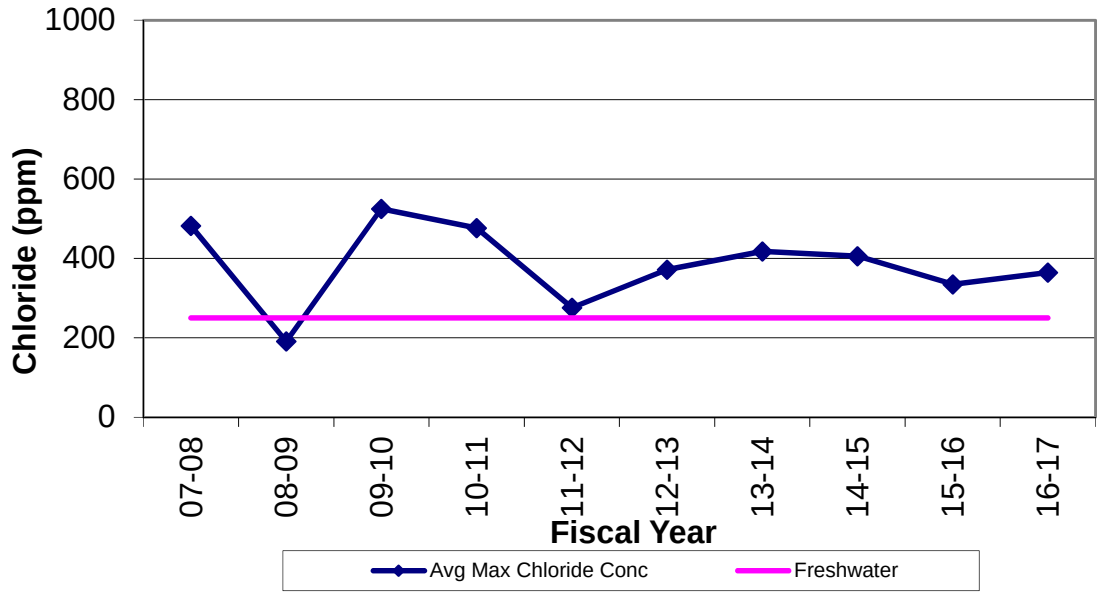


Figure 11b: B-Zone Chloride East of San Gabriel River



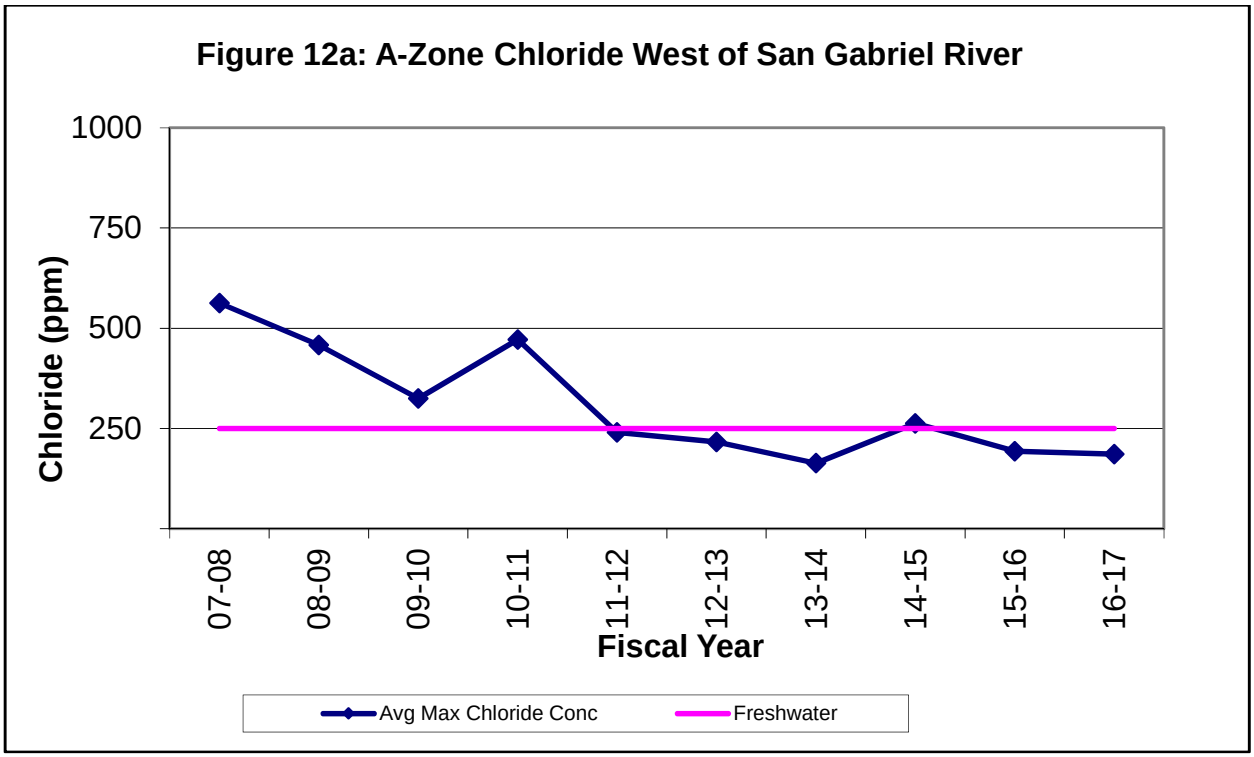


Figure 12a: A-Zone Chloride West of San Gabriel River
1000
750
500
250
Chloride (ppm)
07-08
08-09
09-10
10-11
11-12
12-13
13-14
14-15
15-16
16-17
Fiscal Year
Avg Max Chloride Conc
Freshwater

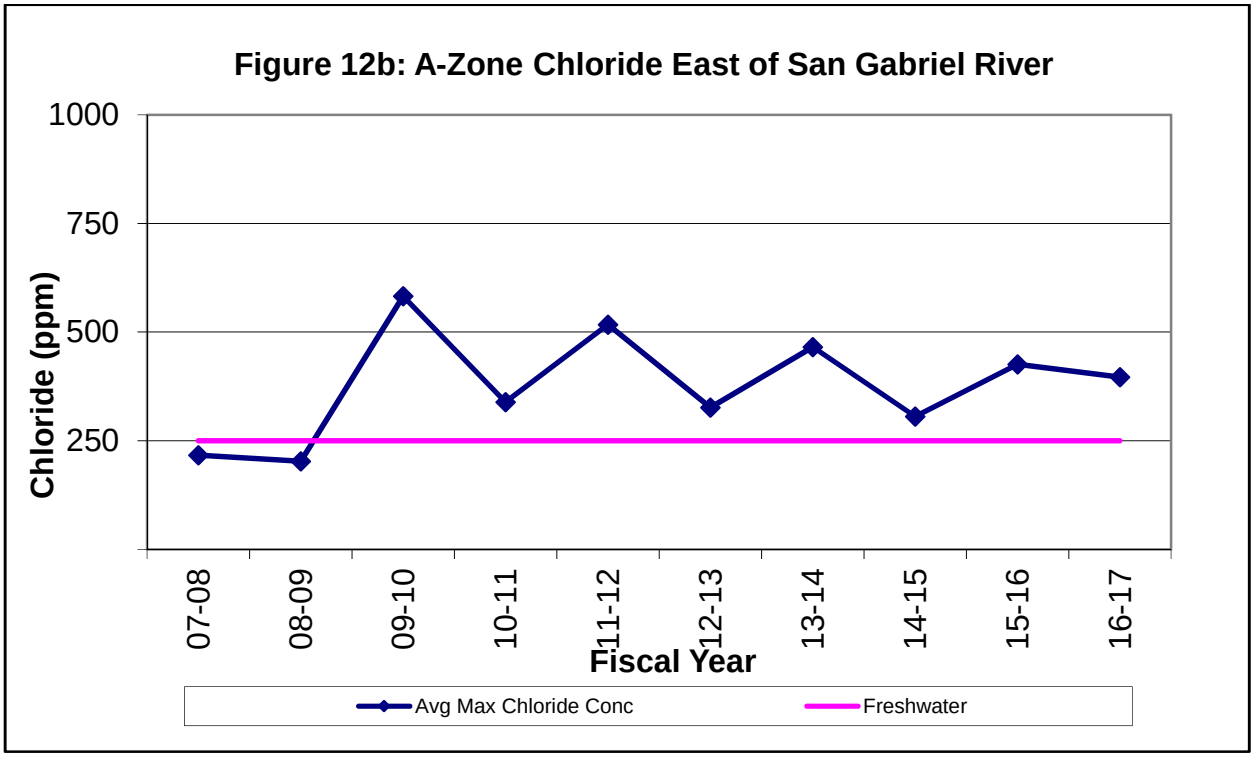


Figure 12b: A-Zone Chloride East of San Gabriel River
1000
750
500
250
Chloride (ppm)
07-08
08-09
09-10
10-11
11-12
12-13
13-14
14-15
15-16
16-17
Fiscal Year
Avg Max Chloride Conc
Freshwater

Figure 13a: I-Zone Chloride West of San Gabriel River

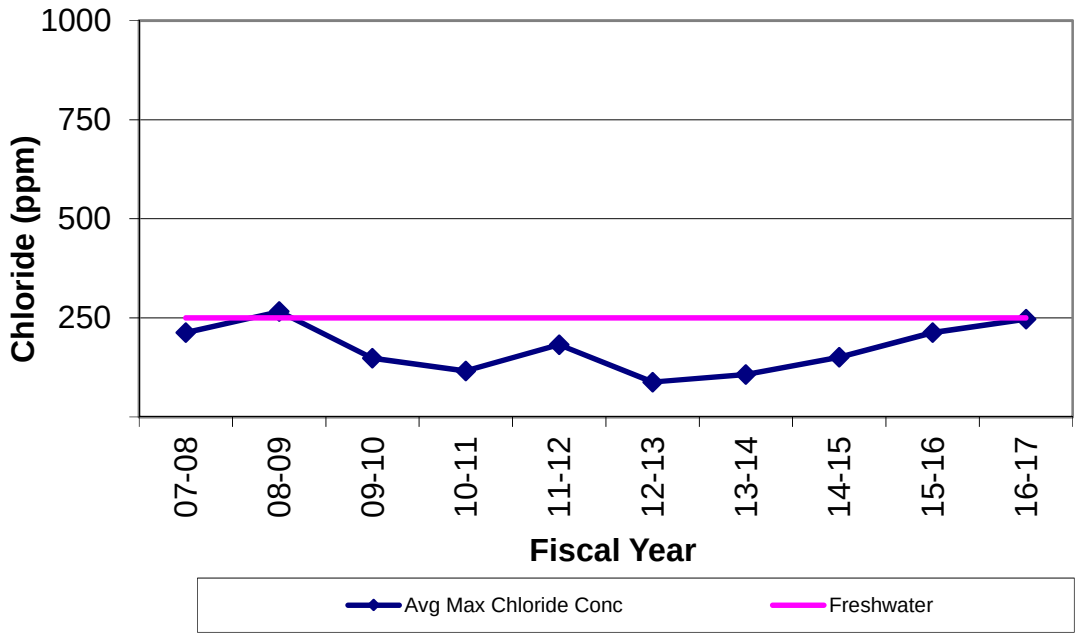
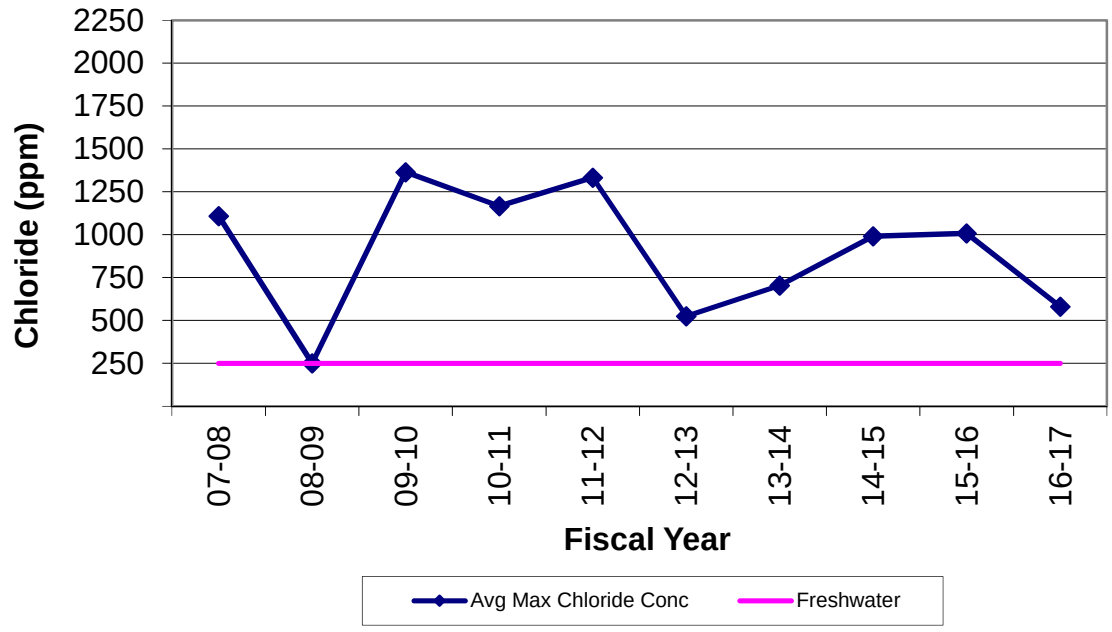


Figure 13b: I-Zone Chloride East of San Gabriel River



West of the San Gabriel River, FY 2016-17 average maximum chloride concentrations in the R and C Zones decreased. R Zone chloride concentrations decreased by more than 500 mg/L, while decreasing only slightly in the C Zone. Average maximum chloride concentrations increased slightly in the B and I Zones, and remained relatively constant in the A zone.

East of the San Gabriel River, FY 2016-17 average maximum chloride concentrations remained constant in the B Zone and slightly decreased in the R and A zones. Chloride concentrations increased in the C Zone by almost 200 mg/L. Average chloride concentrations decreased in the I zone east of the San Gabriel River, resulting primarily from skipping inter-nodal sample collection along the Los Alamitos Channel, which typically have elevated Chloride concentrations, due to construction of OCWD's ABP Unit 14 Project.

Chloride concentration contour maps for the R, C, B, A, and I Zones have been prepared from data collected in the Spring of 2017 and are included in Appendix A-6.1, A-7.1, A-8.1, A-9.1, and A-10.1, respectively. The chloride contour maps are based on the maximum chloride concentration (mg/L) measured at each observation well. Chloride data was gathered from observation wells located within the immediate vicinity of the barrier and does not represent basin-wide conditions for the groundwater basin protected by the barrier. Wells with chloride concentrations of 250 mg/L or less were considered fresh. The chloride measurements used in this report were taken during the semi-annual sampling event in March and April 2017 and the annual event in February and March 2017.

Contours of **changes** in chloride concentration for the R, C, B, A, and I Zones between Spring 2016 and Spring 2017 are shown in Appendices A-6.2, A-7.2, A-8.2, A-9.2, and A-10.2, respectively. The data set is based on available data for Spring 2017, which was then subtracted from the corresponding data for Spring 2016. These contours very clearly identify areas where chloride concentrations increased and decreased between these two reporting periods.

The chloride concentration contours for FY 2016-17 are similar in shape and pattern to those of the previous year. The current contours and the corresponding chloride concentration cross-section (A-11) for this reporting period indicate that intrusion of seawater across the barrier continued to be controlled west of the San Gabriel River. East of the San Gabriel River, several areas recorded elevated chloride concentrations indicating seawater intrusion. Additional areas of high chloride concentrations and/or notable changes in concentration (since the FY 2015-16 report) are as follows:

- R Zone – High chloride concentrations continued to remain present north of the west leg along Los Cerritos Channel. While concentrations decreased significantly at wells 33T29 and 33Y10 on the order 3,500 mg/L, concentrations increased approximately 2,000 mg/L at well 33L30. Chloride concentrations decreased to the north and east of the barrier, including notable decrease of approximately 1,000 mg/L at well 34F5. High chloride concentrations also remained present in the immediate vicinity of well 34L'1 on the east leg.
- C Zone – West of the Los Cerritos Channel, elevated chloride concentrations persist north of the barrier. Chloride concentrations at Well 33T13 continued to increase, while concentrations at 33U11 decreased. Chloride concentrations started to increase along the barrier's east leg, showing an increase of over 300 mg/L at well 34L'1. Well 34X40 also showed an increase of over 600 mg/L, while well 35K1 at the far eastern end of the barrier showed a decrease of about 350 mg/L.
- B Zone – Elevated chloride concentrations continued to be present west of the barrier, with significant increases at 32Z'5. North of the barrier, chloride concentrations increased slightly, with a couple of wells such as 33W11 and 33T4 increasing over 200 mg/L from the previous year. Likewise, concentrations increased by over 300 mg/L at well 34JL. Chloride concentrations remained elevated and even increased east of the barrier at 34U8.
- A Zone – The elevated chloride concentrations northwest of the ABP's west leg

continued to be present from the previous reporting period. West and seaward of the barrier, chloride concentrations decreased at ABP well 32V'10 while increasing at well 32Z'5. Chloride concentrations remained consistent between the Los Cerritos and Los Alamitos Channels. Chloride concentration increased dramatically at well 34HJ, most likely due to lack of injection capacity within the A zone due to the loss of injection well 34H(A).

- I Zone – Chloride concentrations remained below 250 mg/L along the west leg and northward of the barrier, with the exception of wells 33X10, 33X20, and 33S40 which remain elevated. In addition, well 33X20 continued to increase by nearly 2500 mg/L over the past two reporting periods. Along the east leg of the barrier, chloride concentrations decreased at well 34JL while increasing dramatically at 34VZ, and remaining elevated at 35E0.1. Consistent high concentrations at 35F20 and 34X40 suggest that the barrier does a poor job of preventing seawater intrusion in this area.

There continue to be three possible causes of the high chloride concentrations in all zones north of, northwest of, and along portions of the ABP west leg (which was in steady operation during this reporting period). These include the remaining seawater from previous intrusions, migration of seawater inland by the Los Cerritos Channel, and suspected intrusion around the west end of the barrier. Elevated chloride concentrations in the area immediately north of the west leg and west of the barrier will continue to be monitored using the new observation wells constructed by LACDPW in the 2013-14 reporting period.

BARRIER PROJECT COSTS

This section of the report is divided into four parts: Water Costs, Services and Supplies Costs (operation and maintenance), Fixed Assets Costs (capital outlay), and Budget. Under the terms of the 1964 Cooperative Agreement between LACFCD and OCWD, fixed assets are typically divided into facilities paid for by the LACFCD, facilities paid for by the OCWD, and joint facilities paid for by both agencies, depending on their location. Under the same agreement, water costs are divided between the LACFCD (whose portion is paid by the WRD per a separate agreement) and the OCWD. The total cost of the ABP in FY 2016-17 (not including liability insurance) was $8,521,864, which can be broken down as follows: water costs of $6,794,079, Operations and Maintenance costs of $1,652,196, and joint liability insurance for the ABP of $75,588.

WATER COSTS

During FY 2016-17, 6,060.0 AF of water were injected at an estimated total cost of $6,794,079. The monthly unit water cost (dollars per AF) from July 2016 to June 2017 varied periodically as shown earlier in Table 1. The monthly quantity of water injected and total water costs paid by each agency are shown below in Table 2.

TABLE 2. QUANTITY OF WATER INJECTED AND COSTS

MONTH	AMT BY WRD (AF)	AMT BY OCWD (AF)	TOTAL AMT (AF)
Jul-16	423.3	171.9	595.2
Aug-16	441.1	136.1	577.2
Sep-16	416.1	120.4	536.5
Oct-16	451.5	113.6	565.1
Nov-16	447.6	105.4	553.0
Dec-16	457.0	99.0	556.0
Jan-17	443.4	93.3	536.7
Feb-17	376.2	73.9	450.1
Mar-17	396.5	72.8	469.3
Apr-17	374.5	67.2	441.7
May-17	337.8	56.7	394.5
Jun-17	329.9	54.8	384.7
TOTAL INJECTED	**4894.9**	**1165.1**	**6060.0**
TOTAL COST ($) [From Tbl. 1]	**$5,523,014**	**$1,271,066**	**$6,794,079**

OPERATIONS AND MAINTENANCE COSTS

A total of $1,652,196 was spent on Operations and Maintenance during FY 2016-17. Pursuant to the 1964 Cooperative Agreement, the OCWD pays a percentage of the applicable services and supplies costs for injection operations proportional to the percentage of the total amount of injection water paid for by the OCWD. The distribution of FY 2016-17 services and supplies costs is summarized in Table 3.

TABLE 3. DISTRIBUTION OF SERVICES AND SUPPLIES COSTS FOR INJECTION AND EXTRACTION ACTIVITIES

ITEM	LOS ANGELES COUNTY	ORANGE COUNTY	TOTAL
Service & Supplies of Injection Facilities (including Observation Wells)	$ 1,343,164.95	$ 307,521.39	$1,650,686
Service & Supplies of Extraction Facilities	$1,510	$0	$1,510
Right of Way Acquisition	$0	$0	$0
SUBTOTAL	**$1,344,675**	**$307,521**	**$1,652,196**
Liability Insurance	$37,794	$37,794	$75,588
TOTAL	**$1,382,469**	**$345,315**	**$1,727,784**

The values in Table 3 come from the ABP FY 2016-17 Costs (see A-19) as follows:

[1] The sum of Items 1, 2, 3, 7, 8, 9, 10, 11, 12, 13, and 14. OCWD is responsible for 19.2% of all costs for these items except for Item 10 (OCWD pays their proportional share of 33% of total yard maintenance expenditures by agreement).

[2] The sum of Items 4, 5, and 6. OCWD is not responsible for any portion of the cost for these items.

The yearly cost of the services and supplies (including special programs but excluding water and extraction costs) for the last 10 years of ABP operations are shown in Table 4.

TABLE 4. COSTS OF SERVICES AND SUPPLIES FOR INJECTION[1]

Fiscal Year	Volume of Water Injected (Ac-Ft)	Total Cost	Cost Per Ac-Ft Injected
2007-08	5,971.1	$3,513,957	$588.49
2008-09	7,936.2	$1,875,902	$236.37
2009-10	5,629.2	$3,135,608	$557.03
2010-11	5,066.1	$2,830,801	$558.77
2011-12	4,334.7	$2,368,788	$546.47
2012-13	5,490.4	$2,477,565	$451.25
2013-14	6,692.3	$3,605,859	$538.81
2014-15	7,113.1	$1,678,123	$235.92
2015-16	6,807.7	$2,237,637	$328.69
2016-17	6,060.0	$1,650,686	$272.39

[1]The costs reported in Table 4 prior to the FY14-15 period are higher because these years included costs for multiple repairs and/or capital improvement projects.

The costs of the services and supplies for extraction operations for the last 10 years, including electrical costs, are shown in Table 5.

TABLE 5. COSTS OF SERVICES AND SUPPLIES FOR EXTRACTION

Fiscal Year	Volume of Water Extracted (Ac-Ft)	Total Cost	Cost Per Ac-Ft Extracted
2007-08	0.0	$4,224	N/A
2008-09	0.0	$14,742	N/A
2009-10	0.0	$20,223	N/A
2010-11	0.0	$4,552	N/A
2011-12	0.0	$6,219	N/A
2012-13	0.0	$70,408	N/A
2013-14	0.0	$6,768	N/A
2014-15	0.0	$13,714	N/A
2015-16	0.0	$6,961	N/A
2016-17	0.0	$1,510	N/A

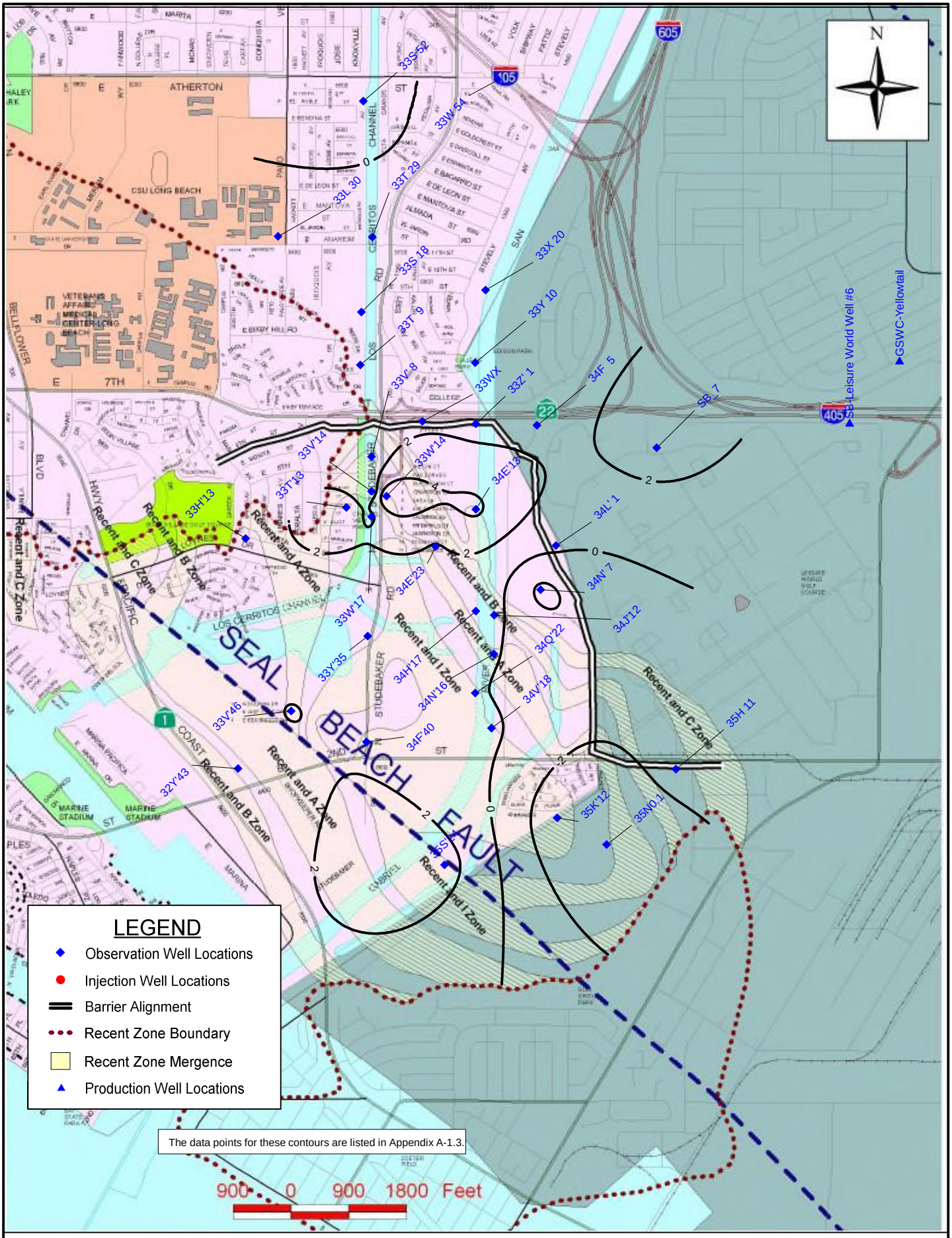
FIXED ASSETS

During FY 2016-17 OCWD constructed new facilities as part of the ABP Unit 14 Project. Injection wells 34J(C,B), 34K(C,B), 34N(C,B), 34N(A), 34N(I), 34Q(C,B), 34Q(A), 34Q(I), 34T(C,B), 34T(A), 34T(I), 34X(B), 34X(A), 34X(I), 34Z2(A), 34Z2(I), 35E(A,I), nested observation wells 34HJ, 34S0.1, 34V3, 34Y0.1, and shallow piezometers PZ6, PZ7, PZ8, and PZ9 were constructed along the east leg of the ABP adjacent to the Los Alamitos Channel. LACFCD entered a cost sharing agreement with OCWD to participate in the proportional cost of injection wells 34J(C,B) and 34K(C,B) and monitoring well 34HJ which are located between Points B and C. The cost for the ABP Unit 14 Project Phase 1 (well construction) was approximately $10M, and Phase 2 (wellhead completion) was awarded for approximately $3.5M.

BUDGET

The FY 2018-19 budget for the cost of ABP Supplies and Services is $1,860,000. A breakdown of this amount, along with past expenditures per category, is shown in Appendix A-20.

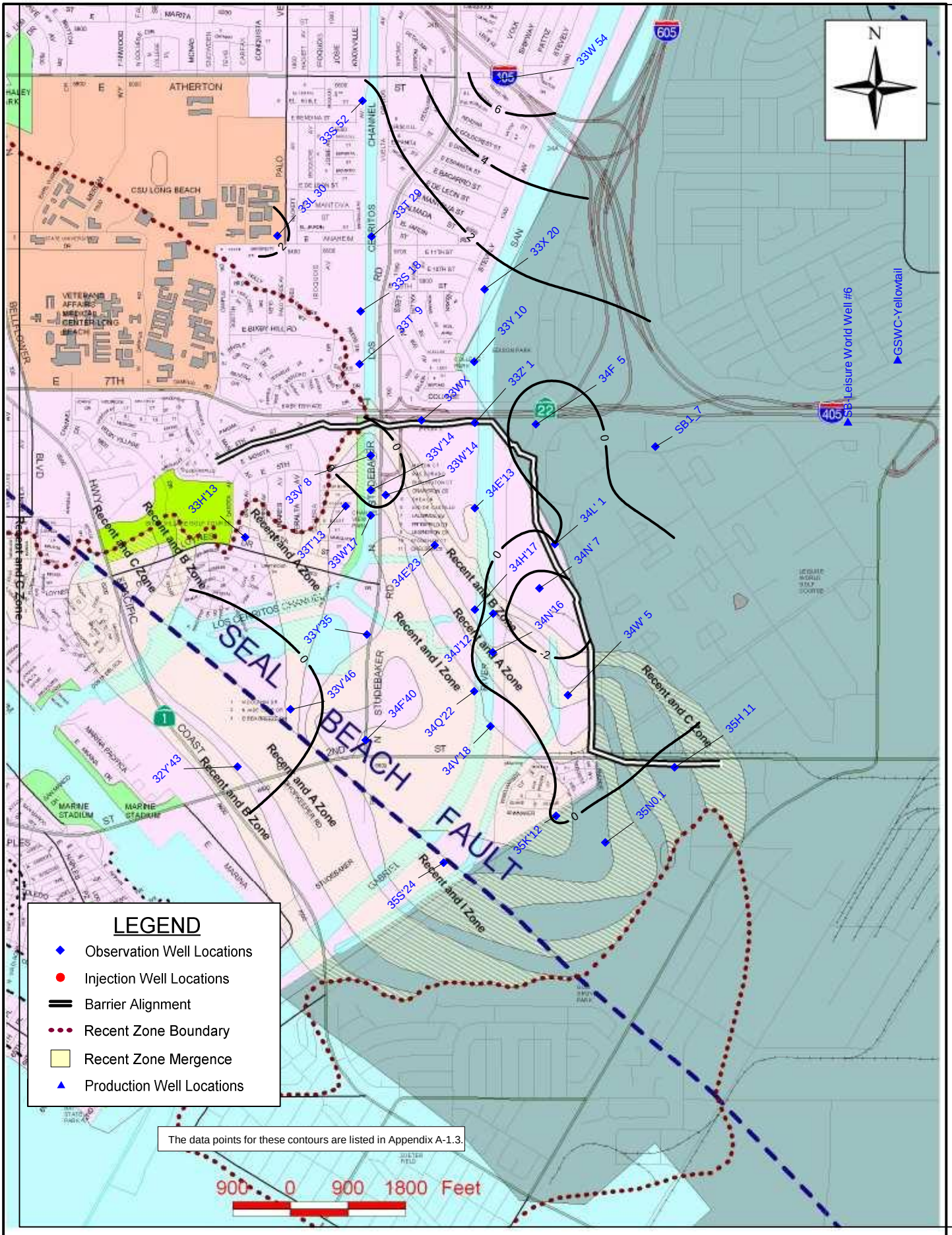
APPENDIX



Alamitos Barrier Project
R Zone Groundwater Elevation (ft) Contours Spring 2017

A-1.1

R zone GW.srf



Alamitos Barrier Project
R Zone: Change in Elevation (ft), Spring 2016 to Spring 2017

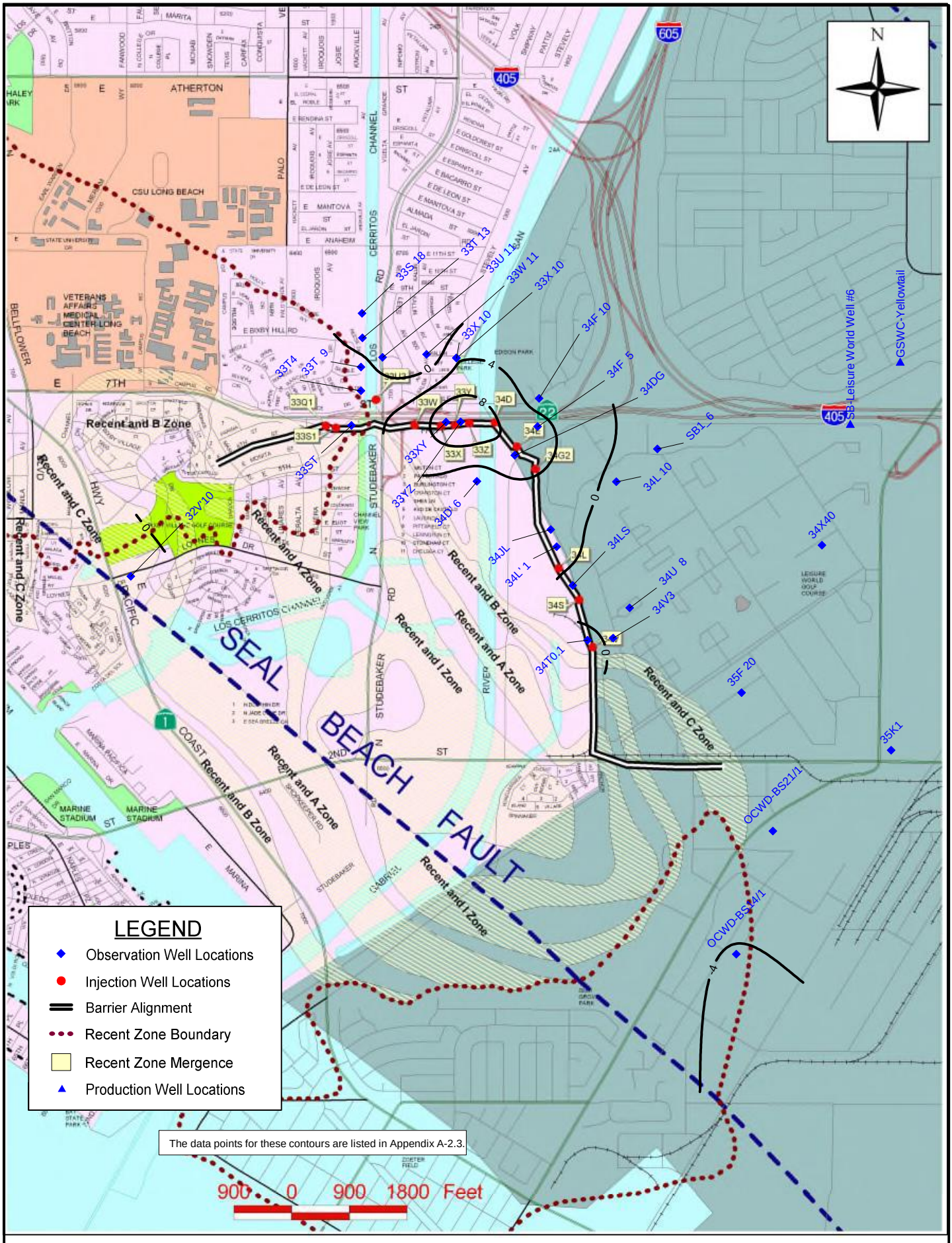
A-1.2

R zone GW.srf

ALAMITOS BARRIER PROJECT
R-Zone
Groundwater Elevation Data for Contours and Tables

POINT	PROJ	FCD	AQUIFER	DATE	FY 16-17 ELEV	P.E.[1]	Δ[2]	FY 15-16 ELEV	CHANGE IN ELEV
1	32Y'43	493WW	R	20160921	0.9			1.3	-0.4
2	33H'13	493YY	R,A	20170221	1.6			1.2	0.4
3	33L 30	491G	R	20170228	0.7			-1.6	2.3
4	33S 18	492AH	R	20170222	1.8			1.0	0.8
5	33S 52	491J	R	20170222	-0.9			-2.2	1.3
6	33T 9	492CV	R	20170315	1.1			0.5	0.6
7	33T 29	491D	R	20170223	0.9			0.8	0.1
8	33T'13	492AU	R	20170227	3.3			2.2	1.1
9	33V' 8	492BY	RA	20170307	0.8			1.8	-1.0
10	33V'14	492JJ	R	20170307	0.4			1.2	-0.8
11	33V'46	493UU	R	20160921	2.1			3.2	-1.1
12	33W 54	501C	R	20170223	1.5			-5.7	7.2
13	33W'14	492AT	R	20170223	6.0			6.3	-0.3
14	33W'17	493PP	R	20170307	1.7			1.4	0.3
15	33WX	502AZ	R	20170314	1.6			0.3	1.3
16	33X 20	502L	R	20170320	0.8			-0.7	1.5
17	33Y 10	502BA	R	20170306	0.3			-1.4	1.7
18	33Y'35	493AB	R	20170223	0.2			-1.1	1.3
19	33Z' 1	502AU	R	20170320	1.2			-0.5	1.7
20	34E'13	503AU	R	20170320	4.4			3.1	1.3
21	34E'23	503X	R	20170223	1.8			0.4	1.4
22	34F 5	502BT	R	20170320	1.5			3.1	-1.6
23	34F'40	483J	R	20170223	1.8			0.3	1.5
24	34H'17	503Y	R	20170320	1.3			0.0	1.3
25	34J'12	503U	R	20170308	0.6			2.1	-1.5
26	34L' 1	503P	R	20170314	0.4			0.4	0.0
27	34N' 7	503AE	R	20170320	-2.5			0.9	-3.4
28	34N'16	503W	R	20160926	0.2			1.2	-1.0
29	34Q'22	503T	R	20170320	0.1			-0.2	0.3
30	34V'18	503V	R	20170228	0.4			-1.0	1.4
31	34W' 5	503AH	R	20170222	0.4			1.8	-1.4
32	35H 11	514F	R	20170314	-1.3			-1.6	0.3
33	35K'12	504R	R	20170301	-3.4			-3.3	-0.1
34	35N0.1	504M	R	20170301	-4.0			-4.4	0.4
35	35S'24	504K	R	20170320	2.8			1.3	1.5
36	SB1_7		R	20170314	2.7			1.8	1.0
				AVG=	0.9		AVG=	0.4	

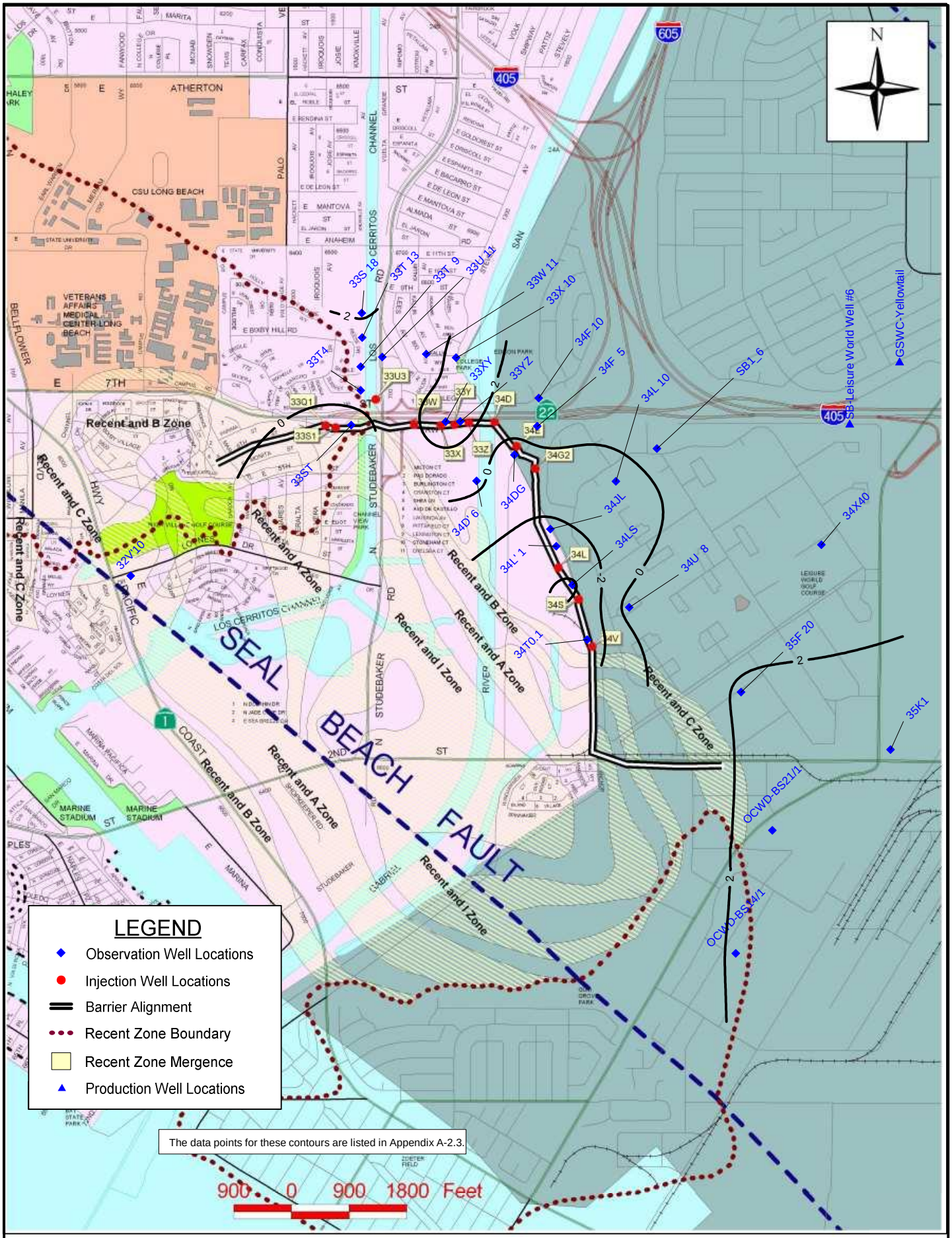
[1] P.E. represents the protective elevations calcuated for internodal wells.
[2] Δ (+/-) represents how much groundwater level is above/below respective P.E.
= A max. or min. elevation during that period.



Alamitos Barrier Project
C Zone Groundwater Elevation (ft) Contours Spring 2017

A-2.1

C zone GW.srf



Alamitos Barrier Project
C Zone: Change in Elevation (ft), Spring 2016 to Spring 2017

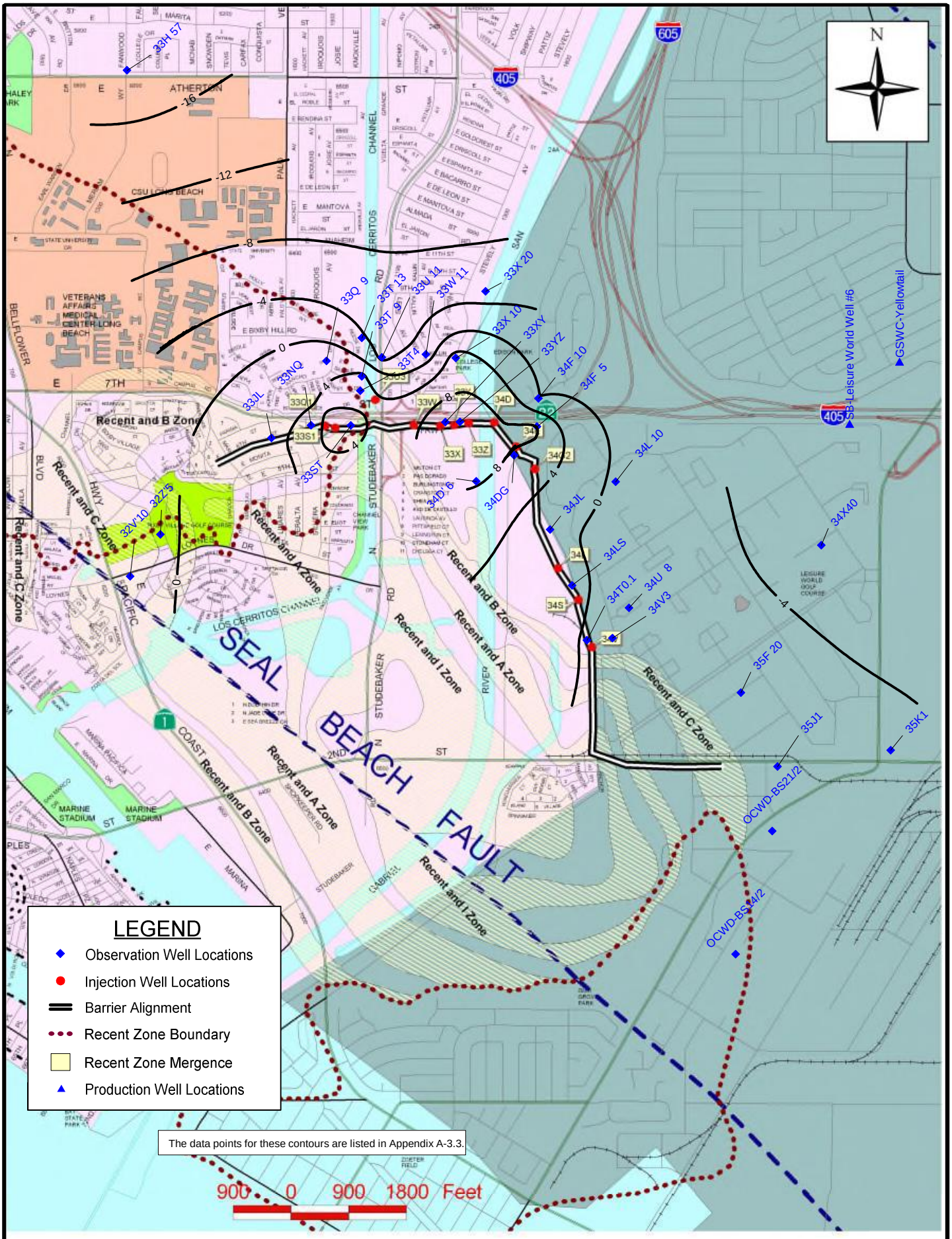
A-2.2

C zone GW.srf

ALAMITOS BARRIER PROJECT
C-Zone
Groundwater Elevation Data for Contours and Tables

POINT	PROJ	FCD	AQUIFER	DATE	FY 16-17 ELEV	P.E.[1]	Δ[2]	FY 15-16 ELEV2	CHANGE IN ELEV
1	32V'10	483H	C	20170228	-0.4			-1.2	0.8
2	33S 18	492AG	C	20170222	-1.1			-3.7	2.6
3	33ST	492BK	CB	20170314	2.6	0.9	1.7	3.6	-1.0
4	33T 9	492CU	C	20170315	3.0			1.7	1.3
5	33T 13	492AC	C	20170316	-2.6			-2.6	0.0
6	33T4	492CT	C	20170315	3.5			2.5	1.0
7	33U 11	492AL	C	20170320	-3.8			-3.8	0.0
8	33W 11	502R	C	20170316	-3.7			-3.7	0.0
9	33X 10	502BB	C	20170320	3.6			0.4	3.2
10	33XY	502BL	C	20170314	10.6	5.4	5.2	7.2	3.4
11	33YZ	502AB	C	20170314	11.8	5.4	6.4	8.9	2.9
12	34D' 6	502BF	C	20170320	0.5			0.0	n/a
13	34DG	502X	C	20170314	7.5	5.4	2.1	9.1	-1.6
14	34F 5	502BU	C	20170320	5.9			4.3	1.6
15	34F 10	502AP	C	20170322	1.7			1.7	0.0
16	34JL	503AR	C	20170314	0.2	4.2	1.8	2.5	-2.3
17	34L' 1	503N	C	20170314	1.1	4.8	1.8	3.7	-2.6
18	34L 10	502AK	C	20170320	-0.9			-0.4	3.7
19	34LS	503BF	C	20170314	-0.6	4.5	-5.1	3.7	-4.3
20	34T0.1	503AB	C	20170314	0.5	3.6	-3.1	3.8	-3.3
21	34U 8	513D	C	20170320	-1.6			-2.4	0.8
22	34V3	503CB	C	20170302	-0.3				n/a
23	34X40	513R	C	20170320	-3.0			-3.0	0.0
24	35F 20	513L	C	20170320	-0.3			-2.5	2.2
25	35K1	523D	C	20170314	-1.9	4.3	-6.2	-5.3	3.4
26	SB1_6			20170314	-1.3			-1.7	0.4
27	OCWD-BS14/1			20170309	-4.2			-6.3	2.1
28	OCWD-BS21/1			20170309	-2.1			-4.6	2.5
					AVG= 0.9			AVG= 0.4	

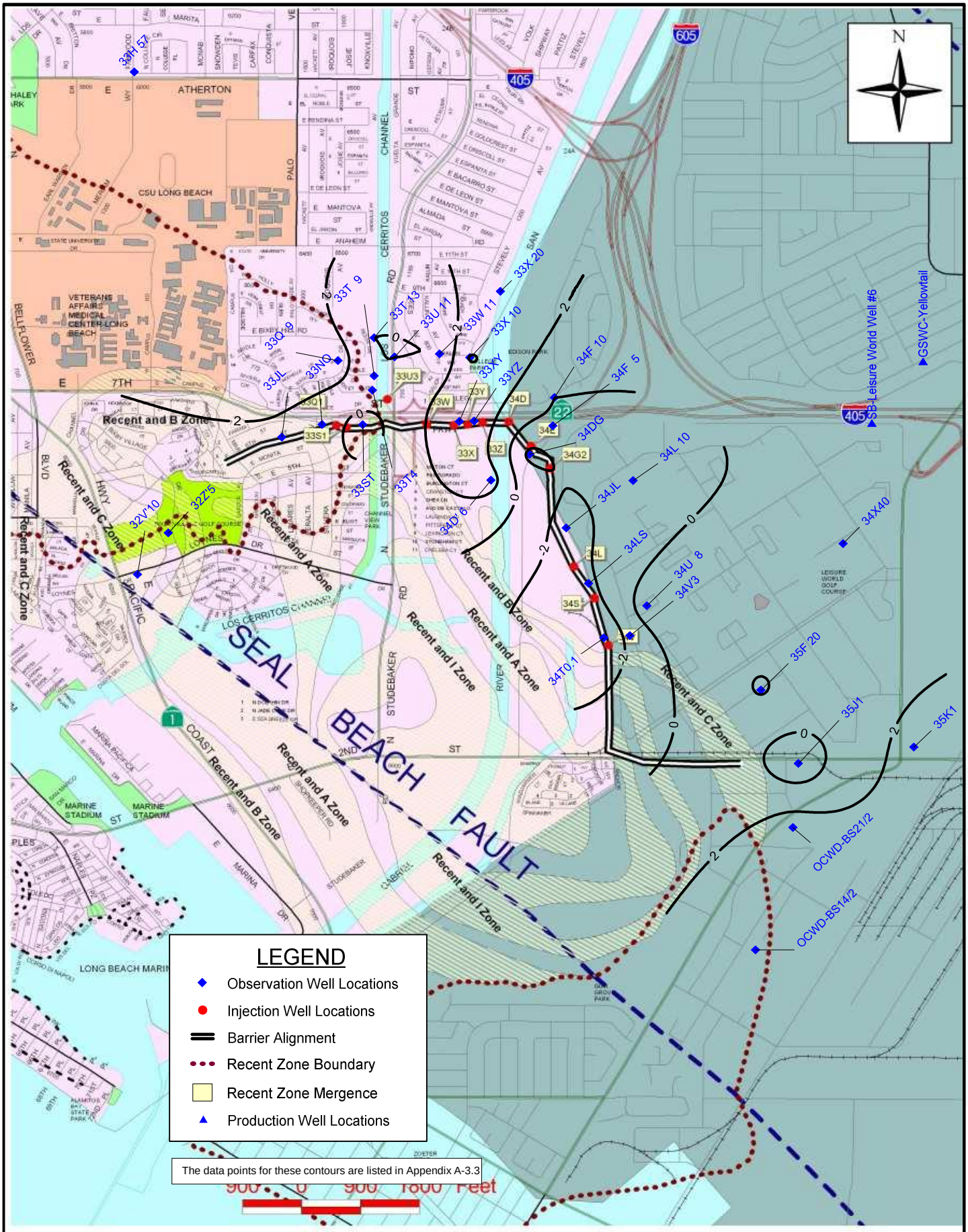
[1] P.E. represents the protective elevations calcuated for internodal wells.
[2] Δ (+/-) represents how much groundwater level is above/below respective P.E.
= A max. or min. elevation during that period.



Alamitos Barrier Project
B Zone Groundwater Elevation (ft) Contours Spring 2017

A-3.1

B zone GW.srf



Date: 06/27/06

Alamitos Barrier Project
B Zone: Change in Elevation (ft), Spring 2016 to Spring 2017

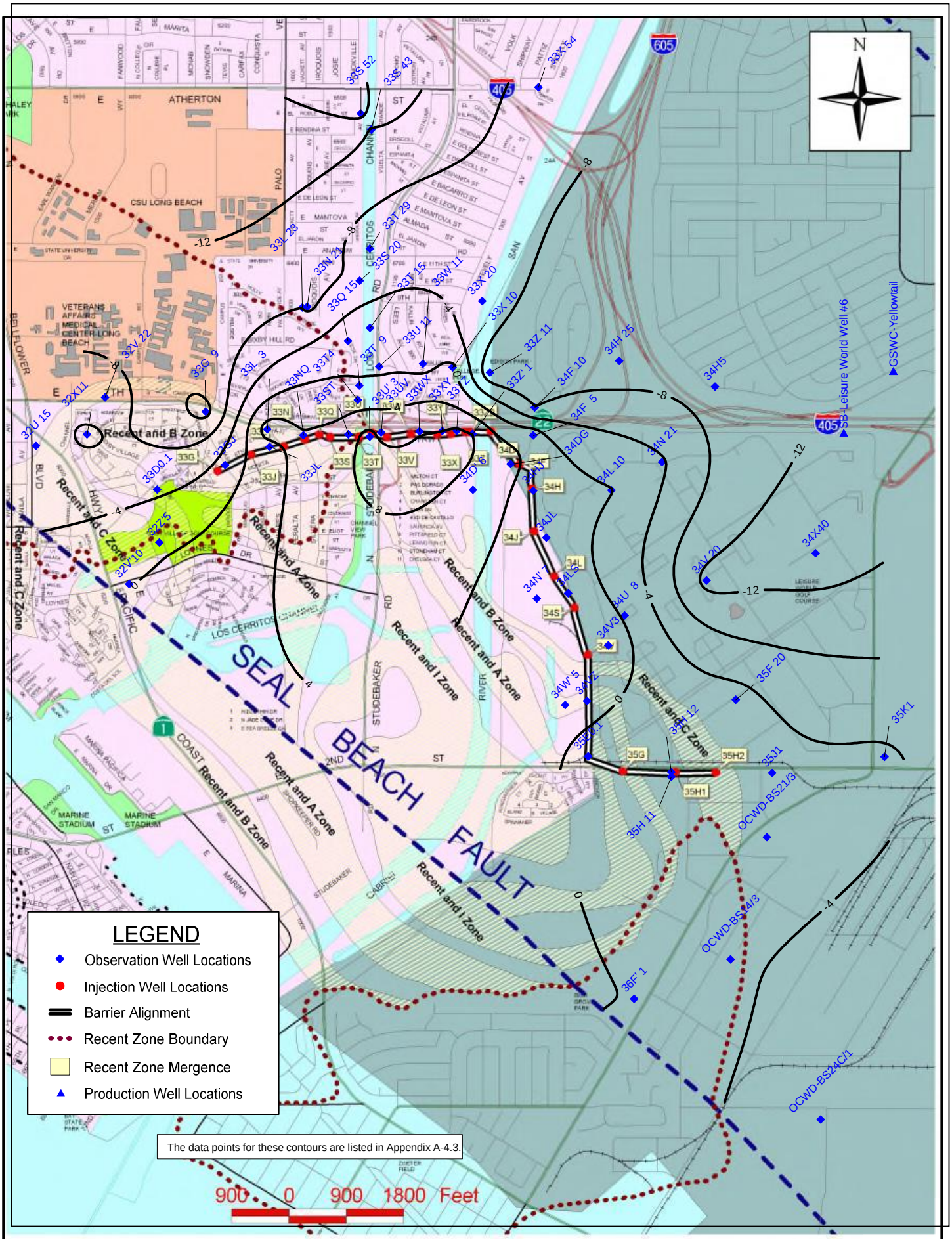
A-3.2

B zone GW.srf

ALAMITOS BARRIER PROJECT
B-Zone
Groundwater Elevation Data for Contours and Tables

POINT	PROJ	FCD	AQUIFER	DATE	FY 16-17 ELEV	P.E.[1]	Δ[2]	FY 15-16 ELEV	CHANGE IN ELEV
1	32V'10	483G	B	20170228	-1.3			-1.4	0.1
2	32Z'5	482W	B,A	20170313	-0.7			-1.6	0.9
3	33H 57	481	B	20170320	-18.6			-21.8	3.2
4	33JL	492BQ	B	20170314	3.7	0.9	2.8	2.0	1.7
5	33NQ	492BN	B	20170314	4.3	0.7	3.6	3.2	1.1
6	33Q 9	492CM	B	20170320	2.7			-0.3	3.0
7	33ST	492BK	C,B	20170314	2.6	0.9	1.7	3.6	-1.0
8	33T 3	492CL	B	20170315	3.4			3.1	0.3
9	33T 9	492YY	B	20170320	4.9			4.9	0.0
10	33T 13	492AB	B	20170316	-3.5			-3.5	0.0
11	33T4	492CS	B	20170315	5.2			3.5	1.7
12	33U 11	492AK	B	20170320	-5.0			-5.0	0.0
13	33W 11	502S	B	20170316	-2.0			-2.0	0.0
14	33X 10	502BC	B	20170320	5.6			1.4	4.2
15	33X 20	502K	B	20170320	-5.5			-8.3	2.8
16	33XY	502BM	B	20170314	10.6	6.3	4.3	6.9	3.7
17	33YZ	502AC	B	20170314	11.3	7.1	4.2	8.2	3.1
18	34D' 6	502BG	B	20170320	8.3			5.5	2.8
19	34DG	502Y	B	20170314	7.6	6.6	1.0	10.1	-2.5
20	34F 5	502BS	B	20170320	8.0			8.3	-0.4
21	34F 10	502AQ	B	20170322	0.1			0.1	0.0
22	34JL	503AQ	B	20170314	0.5	5.3	-4.8	3.0	-2.5
23	34L 10	502AL	B	20170320	-0.6			0.4	-1.0
24	34LS	503BE	B	20170314	1.2	5.4	-4.2	3.5	-2.3
25	34T0.1	503AC	B	20161129	-0.3	9.9	-10.2	3.3	-3.6
26	34U 8	513E	B	20170320	-2.8			-3.9	1.1
27	34V3	503CC	B	20170302	-0.6				n/a
28	34X40	513Q	B	20170320	-5.0			-5.0	0.0
29	35F 20	513K	B	20170320	-2.5			-4.7	2.2
30	35J1	514M	B	20170329	-3.4	5.8	-9.2	-4.6	1.2
31	35K1	523A	B	20170314	-3.4	5.8	-9.2	-6.0	2.6
32	OCWD-BS14/2		B	20170309	-3.2			-6.6	3.4
33	OCWD-BS21/2		B,A	20170309	-2.9			-6.0	3.1
				AVG=	0.6		AVG=	-0.3	

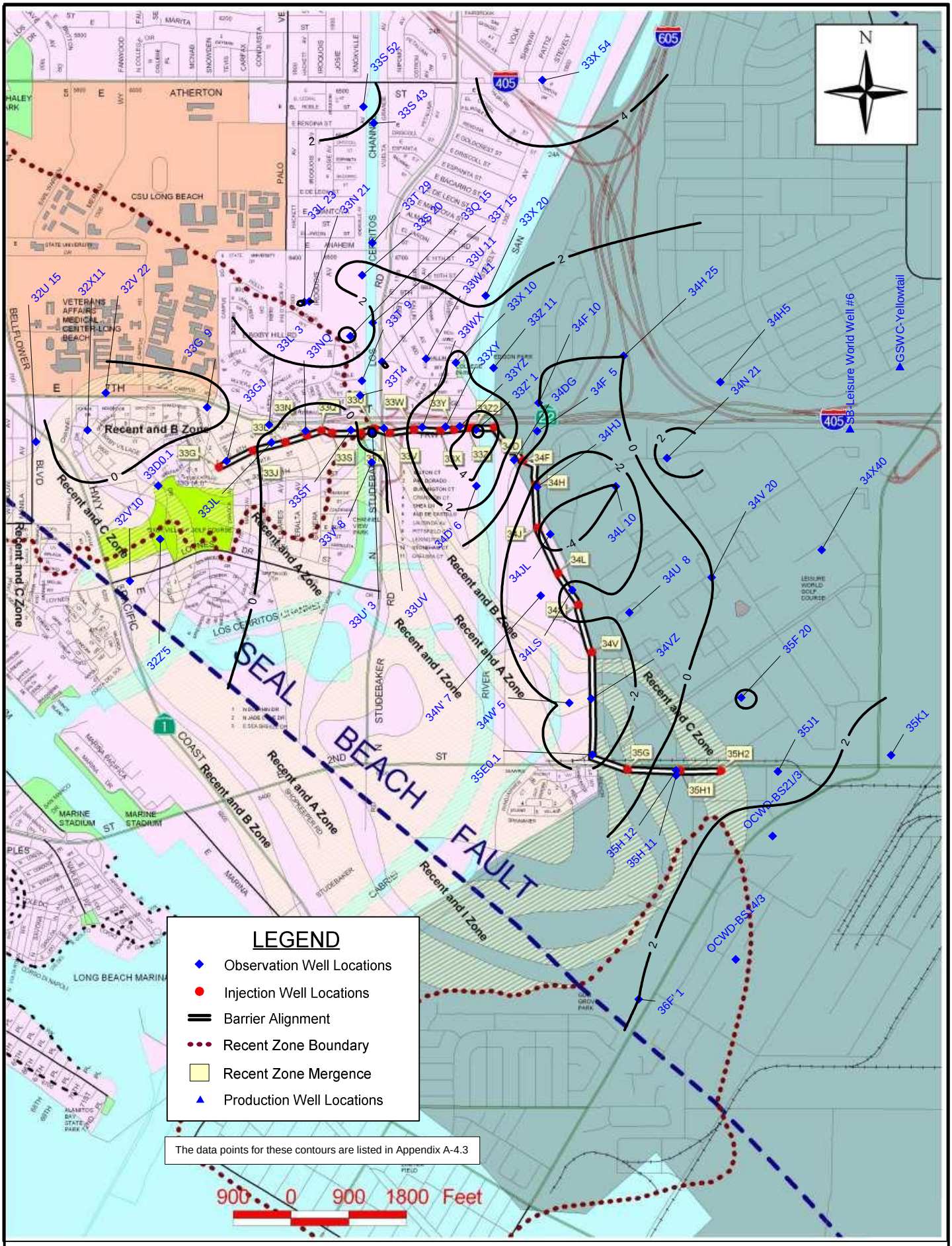
[1] P.E. represents the protective elevations calcuated for internodal wells.
[2] Δ (+/-) represents how much groundwater level is above/below respective P.E.
= A max. or min. elevation during that period.



Alamitos Barrier Project
A Zone Groundwater Elevation (ft) Contours Spring 2017

A-4.1

A zone GW.srf



Alamitos Barrier Project
A Zone: Change in Elevation (ft), Spring 2016 to Spring 2017

A-4.2

A zone GW.srf

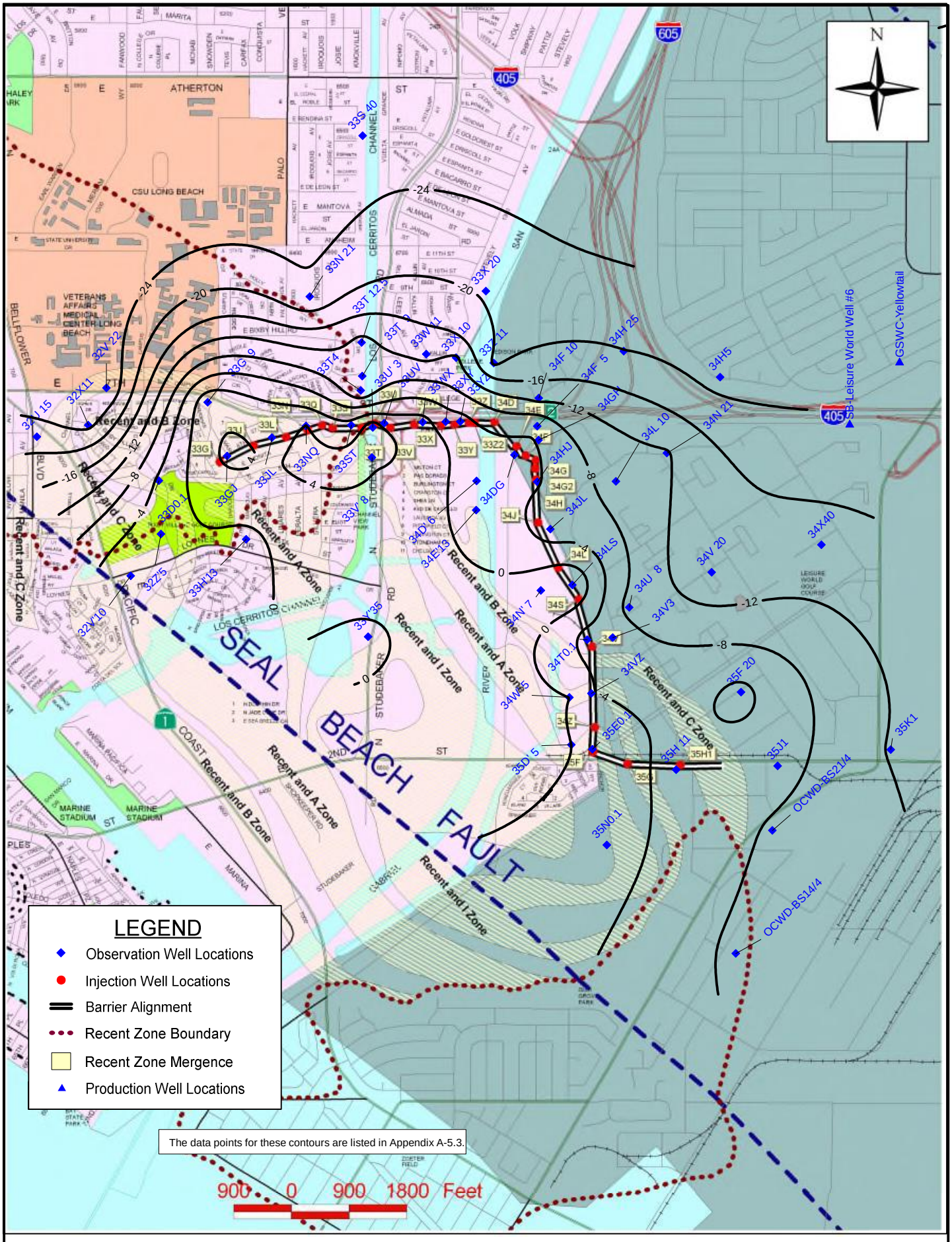
ALAMITOS BARRIER PROJECT
A-Zone
Groundwater Elevation Data for Contours and Tables (Page 1 of 2)

POINT	PROJ	FCD	AQUIFER	DATE	FY 16-17 ELEV	P.E.[1]	Δ[2]	FY 15-16 ELEV	CHANGE IN ELEV
1	32U 15	482M	A	20170309	-6.4			-6.7	0.3
2	32V 22	482P	A	20170221	-5.6			-5.3	-0.3
3	32V'10	483F	A	20170228	-0.1			-0.8	0.7
4	32Z'5	482W	B,A	20170313	-0.7			-1.6	0.9
5	32X11	482S	A	20170315	-8.7			-7.8	-0.9
6	33D0.1	482U	AI	20170315	-3.3			-3.8	0.5
7	33G 9	482F	A	20170221	-13.2			-12.4	-0.8
8	33GJ	482X	A	20170328	3.5	1.4	2.1	2.1	1.4
9	33JL	492BW	AI	20170314	2.8	3.1	-0.3	3.5	-0.7
10	33L 3	492	A	20170308	6.0			5.5	0.5
11	33L 23	492RR	A	20170308	-8.0			-12.2	4.2
12	33N 21	492BU	A	20170227	-8.8			-10.7	1.9
13	33NQ	492BP	A,I	20170314	4.1	3.6	0.5	5.5	-1.4
14	33Q 15	492AM	A	20170301	-1.4			-6.1	4.7
15	33S 20	492BR	A	20170222	-7.5			-8.8	1.3
16	33S 43	491E	A	20170223	-11.6			-13.8	2.2
17	33S 52	491H	A	20170222	-17.0			-18.5	1.5
18	33ST	492BL	A	20170314	5.5	2.8	2.7	6.6	-1.2
19	33T 9	492TT	A	20170316	0.5			0.5	0.0
20	33T 15	492SS	A	20170301	0.0			-2.0	2.0
21	33T 29	491C	A	20170223	-5.7			-8.8	3.1
22	33T4	492CR	A	20170315	2.5			1.5	1.0
23	33U 11	492AJ	A	20170320	-0.7			-0.7	0.0
24	33U' 3	492WW	A	20170223	10.2			7.4	2.8
25	33UV	492BH	A	20170314	5.9	4.0	1.9	5.9	0.0
26	33V' 8	492BY	R,A	20170307	0.8			1.8	-1.0
27	33W 11	502T	A	20170316	-1.5			-1.5	0.0
28	33WX	502AF	A	20170314	7.7	7.6	0.1	4.2	3.5
29	33X 10	502BD	A	20170320	0.9			-1.8	2.7
30	33X 20	502J	A	20170320	-5.2			-7.5	2.3
31	33X 54	501	A,I	20170320	-6.7			-11.9	5.2
32	33XY	502BN	A	20170314	8.0	8.0	0.0	4.3	3.7
33	33YZ	502AD	A	20170314	8.4	7.3	1.1	6.1	2.3
34	33Z' 1	502G	A	20170320	8.0			1.0	7.0
35	33Z 11	502V	A	20170321	-10.7			-10.7	0.0
36	34D' 6	502BH	A	20170320	6.5			2.6	3.9

ALAMITOS BARRIER PROJECT
A-Zone
Groundwater Elevation Data for Contours and Tables (Page 2 of 2)

POINT	PROJ	FCD	AQUIFER	DATE	FY 16-17 ELEV	P.E.[1]	Δ[2]	FY 15-16 ELEV	CHANGE IN ELEV
39	34DG	502Z	A	20170314	4.9	5.4	-0.5	4.3	0.6
40	34F 5	502BR	A	20170320	2.3			1.7	0.6
41	34F 10	502AR	A	20170322	-7.9			-7.9	0.0
42	34H 25	502AH	A	20170322	-10.0			-10.0	0.0
43	34H5	512E	A	20170322	-9.6			-9.6	0.0
44	34HJ	502BX	A	20170314	1.8	8.6	-6.8	4.2	-2.4
45	34JL	503AP	A	20170314	1.4	7.8	-6.4	6.3	-4.9
46	34L 10	502AM	A	20170320	0.1			4.2	-4.1
47	34LS	503BD	A	20170314	1.6	7.6	-6.1	3.0	-1.5
48	34N 21	512B	A	20170301	-3.6			-7.0	3.4
49	34N' 7	503AF	A	20170320	1.0			3.6	-2.6
50	34U 8	513F	A	20170320	-0.4			1.5	-1.9
51	34V3	503CD	A	20170302	2.5				n/a
52	34V 20	513B	A	20170323	-13.1			-13.1	0.0
53	34VZ	503BH	A	20170314	0.9	4.4	-3.5	4.7	-3.8
54	34W' 5	503AJ	A	20170222	1.2			3.2	-2.0
55	34X40	513P	A	20170320	-13.7			-13.7	0.0
56	35E0.1	503BK	A	20170314	-0.9			1.6	-2.5
57	35F 20	513J	A	20170320	-2.5			-4.7	2.2
58	35H 11	514G	A	20170314	-2.0	3.8	-5.8	-3.1	1.1
59	35H 12	514D	A	20170314	-3.2	3.8	-7.0	-4.3	1.1
60	35J1	514L	A	20170329	-3.4			-4.2	0.8
61	35K1	523B	A	20170314	-3.4			-6.0	2.6
62	36F' 1	505D	A	20170222	-0.1			-2.1	2.0
63	OCWD-BS14/3		A	20170309	-3.5			-6.9	3.4
64	OCWD-BS21/3		A	20170309	-2.8			-5.9	3.1
65	OCWD-BS24C/1		A	20170309	-6.7				n/a
				AVG=	-1.8		AVG=	-2.5	

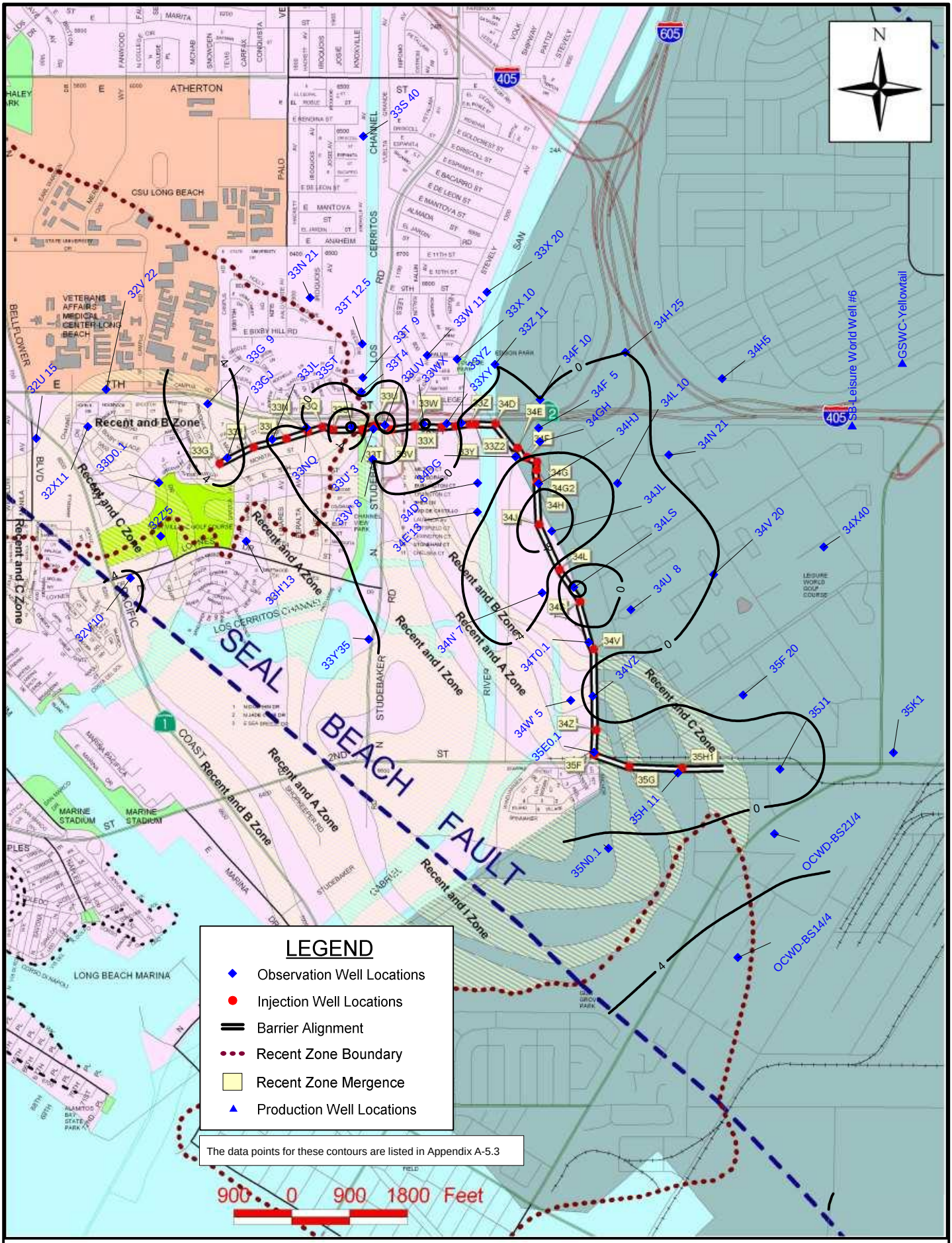
[1] P.E. represents the protective elevations calcuated for internodal wells.
[2] Δ (+/-) represents how much groundwater level is above/below respective P.E.
[ ] = A max. or min. elevation during that period.



Alamitos Barrier Project
I Zone Groundwater Elevation (ft) Contours Spring 2017

A-5.1

I zone GW.srf



Alamitos Barrier Project
I Zone: Change in Elevation (ft), Spring 2016 to Spring 2017

A-5.2

I zone GW.srf

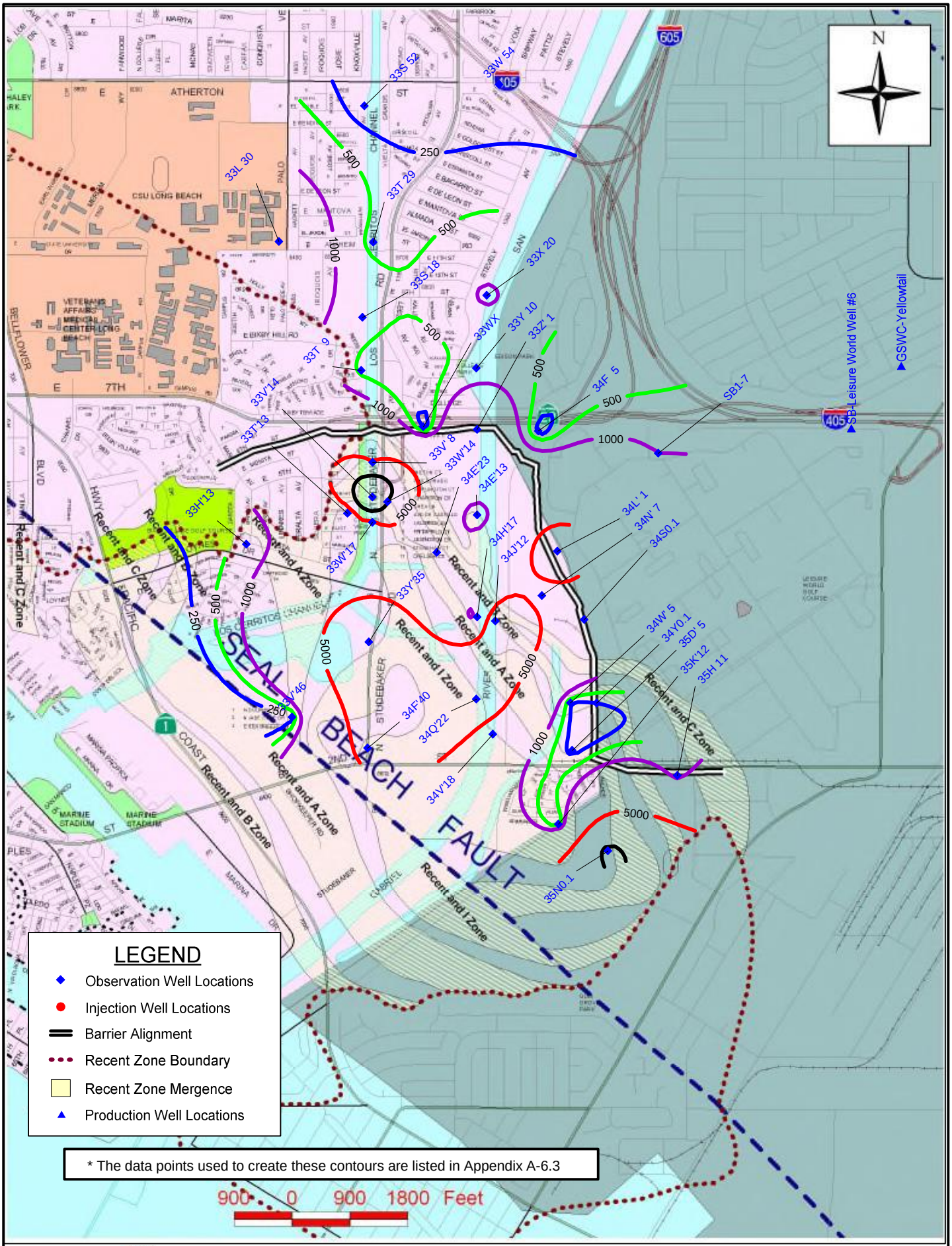
ALAMITOS BARRIER PROJECT
I-Zone
Groundwater Elevation Data for Contours and Tables (Page 1 of 2)

POINT	PROJ	FCD	AQUIFER	DATE	FY 16-17 ELEV	P.E.[1]	Δ[2]	FY 15-16 ELEV	CHANGE IN ELEV
1	32U 15	482L	I	20170309	-21.6			-24.0	2.4
2	32V 22	482N	I	20170221	-27.6			-29.8	2.2
3	32V'10	483E	I	20170227	-0.5			-4.8	4.3
4	32X11	482R	I	20170315	-24.9			-26.6	1.7
5	32Z'5	482V	I	20170313	-1.5			-3.9	2.4
6	33D0.1	482U	A,I	20170315	-3.3			-3.8	0.5
7	33G 9	482G	I	20170221	3.0			-2.8	5.8
8	33GJ	482Y	I	20170328	4.7	2.6	2.1	-1.8	6.5
9	33H'13	493XX	I	20170221	-1.2			-2.7	1.5
10	33JL	492BW	A,I	20170314	2.8	3.1	2.5	3.7	-0.9
11	33N 21	492BV	I	20170227	-23.4			-25.3	1.9
12	33NQ	492BP	A,I	20170314	4.1	3.6	0.5	4.0	0.1
13	33S 40	491F	I	20170222	-24.8			-27.3	2.5
14	33ST	492BM	I	20170314	1.1	4.2	-3.1	10.6	-9.5
15	33T 9	492XX	I	20170316	-11.3			-11.3	0.0
16	33T 12.5	492BT	I	20170228	-10.7			-13.5	2.8
17	33T4	492CQ	I	20170315	-11.5			-12.6	1.1
18	33U' 3	492QQ	I	20170223	6.6			7.6	-1.0
19	33UV	492BJ	I	20170314	2.5	6.1	-3.6	9.8	-7.3
20	33V' 8	492BX	I	20170307	4.1			4.1	0.0
21	33W 11	502U	I	20170316	-13.5			-13.5	0.0
22	33WX	502AG	I	20170314	1.6	10.4	-8.8	-3.2	4.8
23	33X 10	502BE	I	20170320	-11.5			-13.6	2.1
24	33X 20	502H	I	20170320	-16.1			-17.5	1.4
25	33XY	502BP	I	20170314	-2.5	11.0	-13.5	-4.2	1.7
26	33Y'35	493ZZ	I	20170223	-0.5			-0.9	0.4
27	33YZ	502AE	I	20170314	-2.3	11.1	-13.4	-1.8	-0.5
28	33Z 11	502W	I	20170321	-20.5			-20.5	0.0
29	34D' 6	502BI	I	20170320	-2.5			-1.0	-1.5
30	34DG	502AA	I	20170314	-2.6	6.5	-9.1	0.9	-3.5
31	34E'13	503AT	I	20170320	-1.9			1.1	-3.0
32	34F 5	502BQ	I	20170320	-4.6			-2.8	-1.8
33	34F 10	502AS	I	20170322	-13.1			-13.1	0.0
34	34GH	502BV	I	20170314	-4.3	10.5	-14.8	-1.7	-2.6
35	34H 25	502AJ	I	20170322	-19.9			-19.9	0.0
36	34H5	512D	I	20170322	-21.6			-21.6	0.0
37	34HJ	502BW	I	20170314	-3.7	11.0	-14.7	3.9	-7.6
38	34JL	503AN	I	20170314	-6.3	10.5	-16.8	5.2	-11.5

ALAMITOS BARRIER PROJECT
I-Zone
Groundwater Elevation Data for Contours and Tables (Page 2 of 2)

POINT	PROJ	FCD	AQUIFER	DATE	FY 16-17 ELEV	P.E.[1]	Δ[2]	FY 15-16 ELEV	CHANGE IN ELEV
39	34L 10	502AN	I	20170320	-9.6			-6.0	-3.6
40	34LS	503BC	I	20170320	3.9	9.9	-6.0	-2.0	5.9
41	34N 21	512C	I	20170301	-11.7			-12.8	1.1
42	34N' 7	503AG	I	20170320	1.5			7.3	-5.8
43	34T0.1	503AD	I	20170314	-5.7	8.4	-14.1	-4.5	-1.2
44	34U 8	513G	I	20170320	-9.3			-7.9	-1.4
45	34V3	503CE	I	20170302	-4.9				n/a
46	34V 20	513C	I	20170323	-15.4			-15.4	0.0
47	34VZ	503BG	I	20170314	-3.8	6.7	-10.5	-6.4	2.6
48	34W' 5	503AK	I	20170222	0.0			3.0	-3.0
49	34X40	513N	I	20170320	-13.9			-13.9	0.0
50	35D' 5	503AM	I	20170222	0.0				n/a
51	35E0.1	503BJ	I	20170314	-0.7	3.1	-3.8	1.6	-2.3
52	35F 20	513H	I	20170320	-2.9			-4.7	1.8
53	35H 11	514H	I	20170314	-5.3	5.5	-10.8	-2.8	-2.5
54	35J1	513M	I	20170314	-6.6			-3.1	-3.5
55	35K1	523C	I	20170314	-12.3			-16.0	3.7
56	35N0.1	504N	I	20170301	-2.2			-2.9	0.7
57	OCWD-BS14/4		I	20170309	-8.8			-14.1	5.3
58	OCWD-BS21/4		I	20170309	-8.5			-11.3	2.9
				AVG=	-6.8		AVG=	-6.9	

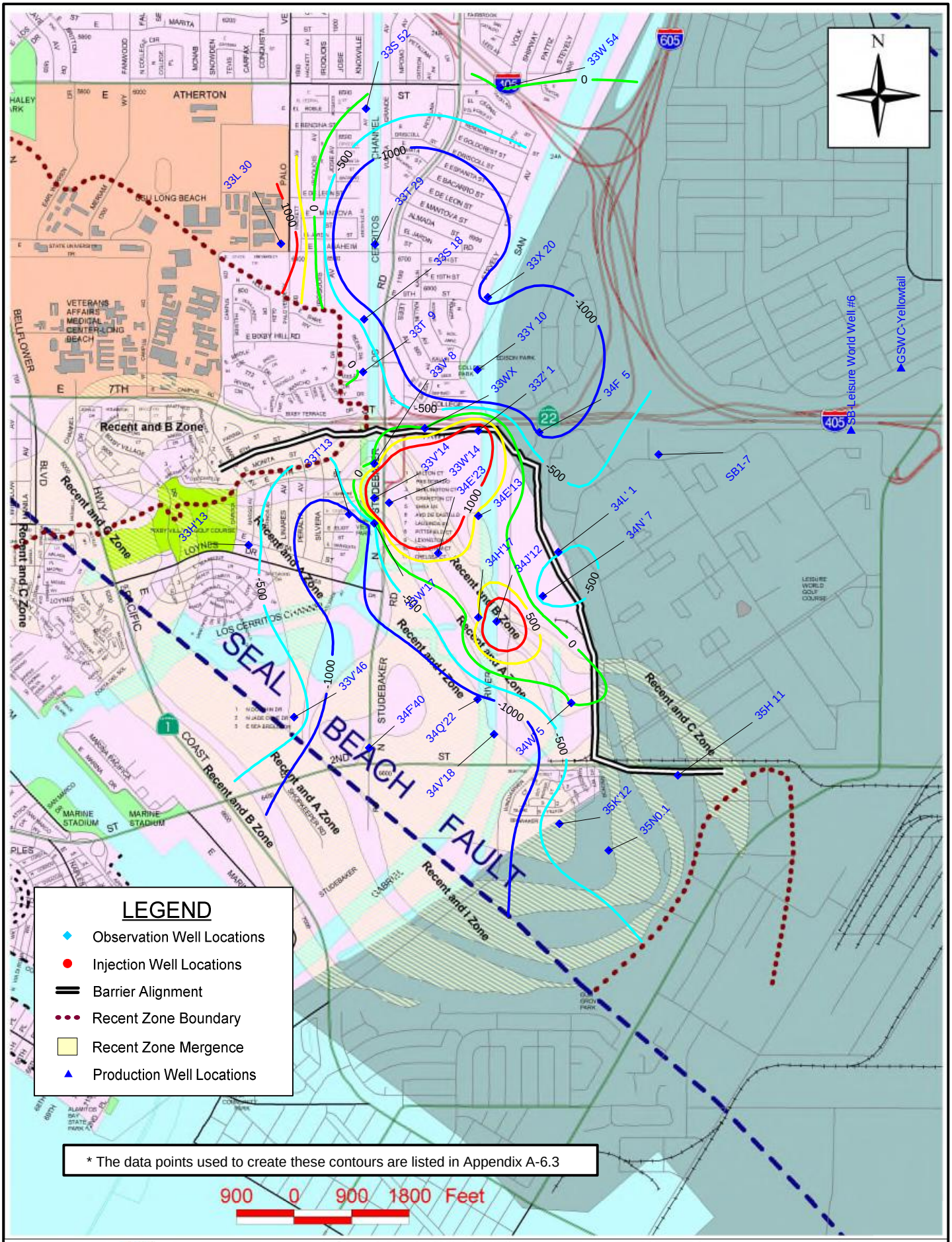
[1] P.E. represents the protective elevations calcuated for internodal wells.
[2] Δ (+/-) represents how much groundwater level is above/below respective P.E.
[ ] = A max. or min. elevation during that period.



Alamitos Barrier Project
R Zone Chloride Concentration (mg/L) Contours: Spring 2017

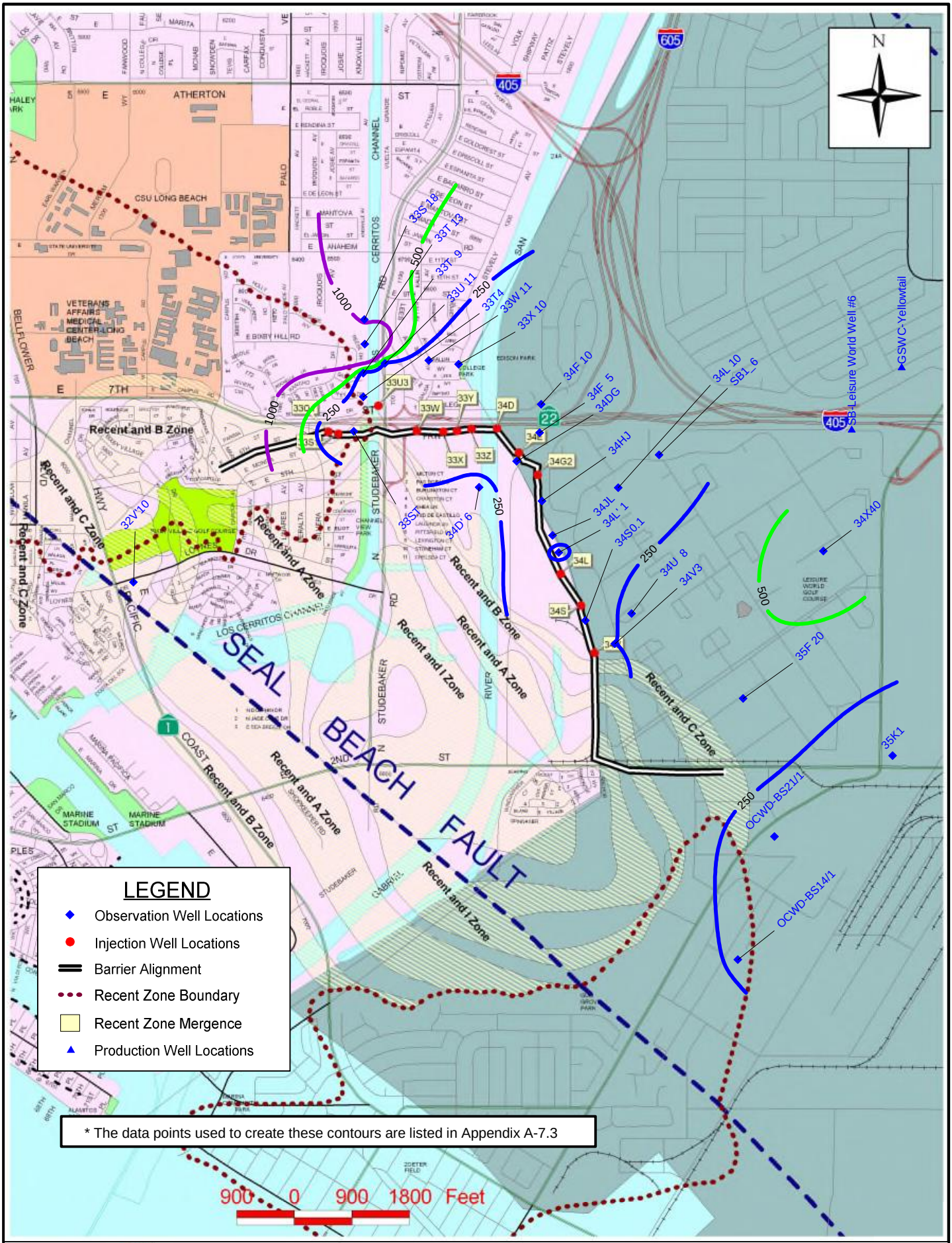
A-6.1

R zone CL.srf


N
LEGEND
Observation Well Locations
Injection Well Locations
Barrier Alignment
Recent Zone Boundary
Recent Zone Mergence
Production Well Locations
* The data points used to create these contours are listed in Appendix A-6.3
900 0 900 1800 Feet
SEAL BEACH FAULT
Recent and A Zone
Recent and B Zone
Recent and C Zone
Recent and I Zone
ATHERTON
LONG BEACH
GSWC-Yellowtail
SB1-Leisure World Well #6
SB1-7
33S 52
33W 54
33L 30
33T 29
33S 18
33X 20
33T 9
33Y 10
33V 8
33WX
33Z 1
34F 5
33T 13
33V 14
33W 14
34E 23
34E 13
33H 13
34L 1
34N 7
34H 17
34J 12
33W 17
33V 46
34F 40
34Q 22
34W 5
34V 18
35H 11
35K 12
35N0.1
Alamitos Barrier Project
R Zone: Change in Chloride Concentration, Spring 2016 to Spring 2017
A-6.2
R zone CL.srf

ALAMITOS BARRIER PROJECT
R-ZONE CHLORIDE CONCENTRATIONS
Chloride Data Used for Contours and Cross-Section

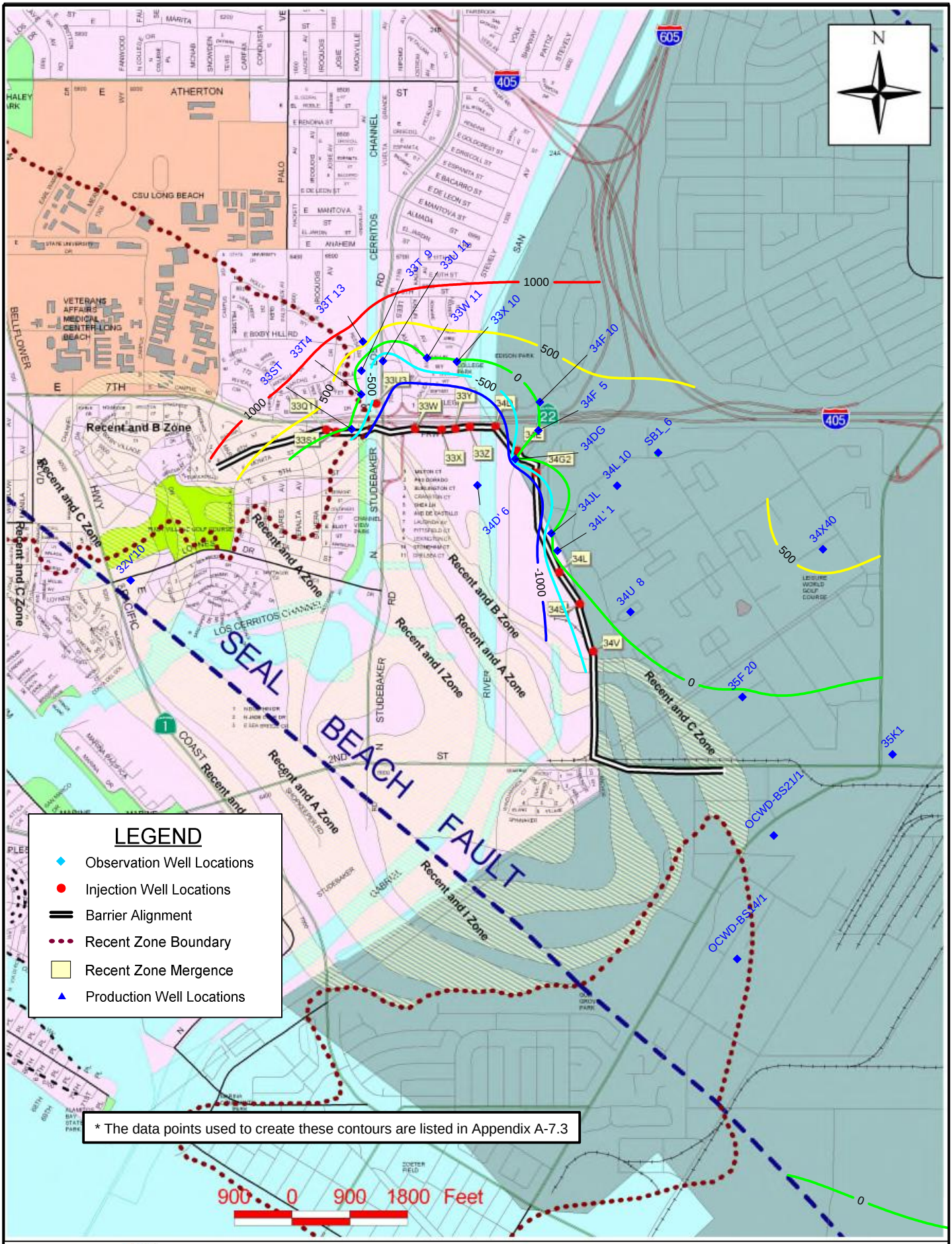
No.	PROJ	FCD	DATE	AQUIFER	For Cross-Section (Internodal Wells in **Bold**)						For Contours	MAX CHLORIDE 15-16	Change in Chloride (FY16-17 - FY15-16)
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 16-17		
1	33H'13	493YY	20170221	(R,A)	-18	620	-38	620	-58	610	620	929	-309
2	33L 30	491G	20170228	RECENT	-50	2,000					2,000	130	1,870
3	33S 18	492AH	20170222	RECENT	-67	760					760	1,360	-600
4	33S 52	491J	20170222	RECENT	-54	110					110	235	-125
5	33T 9	492CV	20170316	RECENT	-21	399					399	404	-5
6	33T 29	491D	20170223	RECENT	-56	370					370	3,890	-3,520
7	33T'13	492AU	20170227	RECENT	-41	2,100	-51	1,700			2,100	3,300	-1,200
8	33V' 8	492BY	20170307	(R,A)	-24	5,100	-48	3,200			5,100	5,040	60
9	33V'14	492JJ	20170307	RECENT	-67	20,000					20,000	17,900	2,100
10	33V'46	493UU	20170322	RECENT	-61	120					120	146	-26
11	33W 54	501C	20170223	RECENT	-33	120	-53				120	101	19
12	33W'14	492AT	20170223	RECENT	-46	5,300	-66	9,500			9,500	2,810	6,690
13	33W'17	493PP	20170307	RECENT	-41	3,200	-51	4,500			4,500	5,310	-810
14	**33WX**	**502AZ**	**20170323**	**RECENT**	**-45**	**50**					**50**	**66**	**-16**
15	33X 20	502L	20170321	RECENT	-68	1,110					1,110	1,850	-740
16	33Y 10	502BA	20170306	RECENT	-58	640	-83	370			640	4,300	-3,660
17	33Y'35	493AB	20170223	RECENT	-36	9,400					9,400		n/a
18	**33Z' 1**	**502AU**	**20170322**	**RECENT**	**-46**	**1,910**	**-56**	**3,260**			**3,260**	**1,620**	**1,640**
19	34E'13	503AU	20170306	RECENT	-19	380	-52	370			380	72	308
20	34E'23	503X	20170223	RECENT	-43	1,500					1,500	826	674
21	34F 5	502BT	20170322	RECENT	-136	77	-146	79	-156	62	79	1,180	-1,101
22	34F'40	483J	20170223	RECENT	-40	5,900					5,900	9,060	-3,160
23	34H'17	503Y	20170306	RECENT	-46	400					400	218	182
24	34J'12	503U	20170308	RECENT	-28	8,400	-36	8,300			8,400	5,660	2,740
25	**34L' 1**	**503P**	**20170320**	**RECENT**	**-57**	**7,120**					**7,120**	**7,600**	**-480**
26	34N' 7	503AE	20170222	RECENT	-51	2,400	-61	4,200	-70	1,500	4,200	5,030	-830
27	34Q'22	503T	20170308	RECENT	-42	8,000	-57	8,700			8,700	9,830	-1,130
28	34S0.1	503BT	20160929	RECENT		3,030					3,030		n/a
29	34V'18	503V	20170228	RECENT	-48	2,900					2,900	5,220	-2,320
30	34W' 5	503AH	20170222	RECENT	-51	220					220	202	18
31	34Y0.1	503CK	20161107	RECENT		250					250		n/a
32	35D' 5	503AL	20170222	RECENT	-57	180					180		n/a
33	**35H 11**	**514F**	**20170314**	**RECENT**	**-42**	**22**	**-65**	**760**			**760**	**904**	**-144**
34	35K'12	504R	20170301	RECENT	-44	130	-54	200			200	278	-78
35	35N0.1	504M	20170301	RECENT	-38	11,000	-62	11,000			11,000	11,400	-400
36	SB1-7		20170309	R		1,000					1,000	1,000	0



Alamitos Barrier Project
C Zone Chloride Concentration (mg/L) Contours: Spring 2017

A-7.1

C zone CL.srf



Alamitos Barrier Project
C Zone: Change in Chloride Concentration, Spring 2016 to Spring 2017

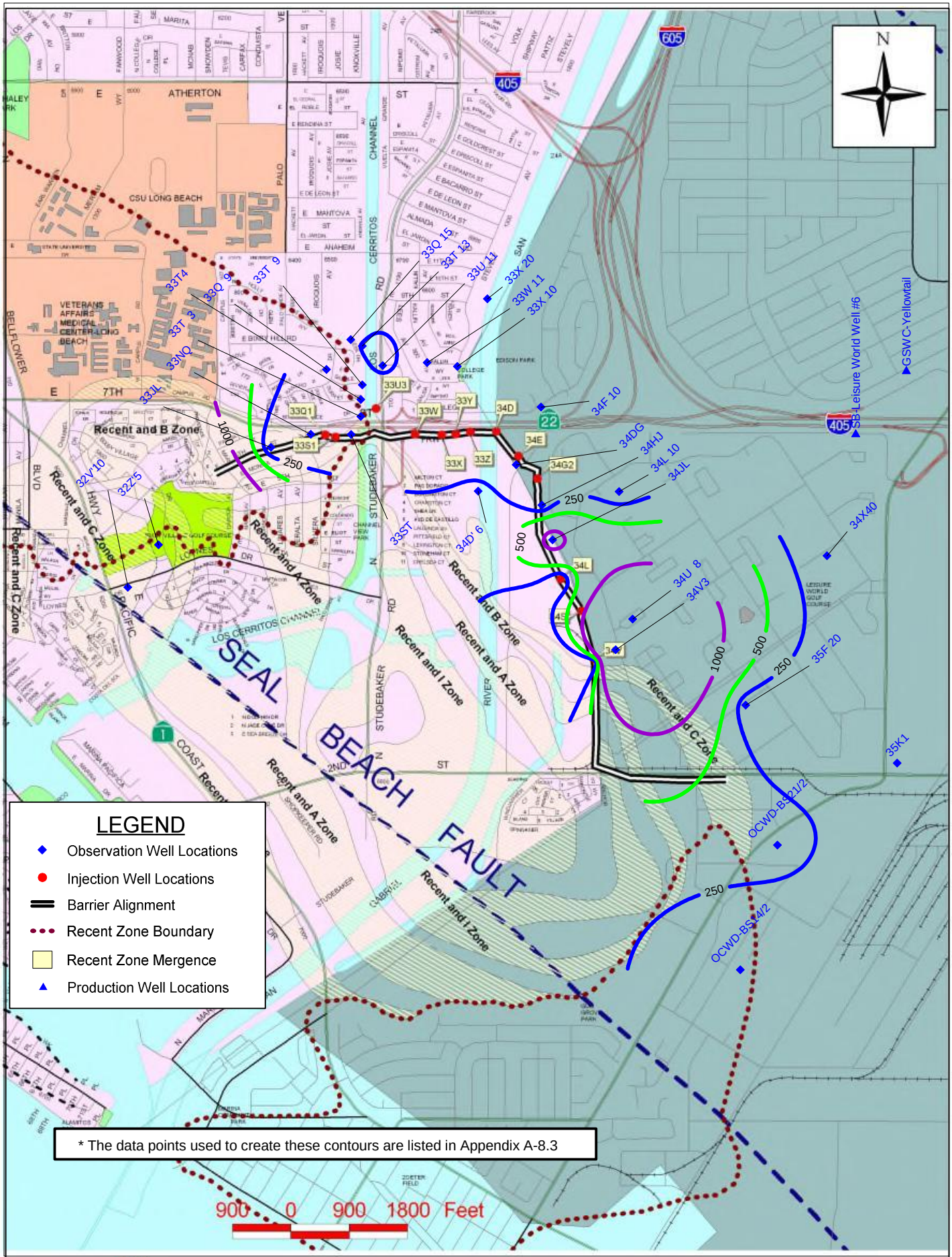
A-7.2

C zone CL.srf

ALAMITOS BARRIER PROJECT
C-ZONE CHLORIDE CONCENTRATIONS
Chloride Data Used for Contours and Cross-Section

No.	PROJ	FCD	DATE	AQUIFER	For Cross-Section (Internodal Wells in **Bold**)						For Contours	MAX CHLORIDE 15-16	Change in Chloride (FY16-17 - FY15-16)
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 16-17		
1	32V'10	483H	20170228	C ZONE	-37	3,200					3,200	1,520	1,680
2	33S 18	492AG	20170222	C ZONE	-225	710					710		n/a
3	**33ST**	**492BK**	**20170314**	**(C,B)**	**-25**	**120**					**120**	**183**	**-63**
4	33T 9	492CU	20170316	C ZONE	-129	102	-144	116			116	357	-241
5	33T 13	492AC	20170316	C ZONE	-199	3,040					3,040	2,330	710
6	33T4	492CT	20170320	C ZONE	-56	118					118	117	1
7	33U 11	492AL	20170320	C ZONE	-188	196					196	1,100	-904
8	33W 11	502R	20170316	C ZONE	-183	100	-216	87			100	78	22
9	33X 10	502BB	20170302	C ZONE	-190	64	-215	64			64	101	-37
10	34D' 6	502BF	20170306	C ZONE	-125	330					330	9,730	-9,400
11	**34DG**	**502X**	**20170321**	**C ZONE**	**-190**	**85**	**-205**	**82**			**85**	**89**	**-4**
12	34F 5	502BU	20170322	C ZONE	-191	83	-201	83	-211	82	83	90	-7
13	34F 10	502AP	20170322	C ZONE	-211	97					97	68	29
14	**34HJ**	**502BA**	**20160812**	**C ZONE**		**123**					**123**		**n/a**
15	**34JL**	**503AR**	**20170328**	**C ZONE**	**-161**	**108**					**108**	**131**	**-23**
16	**34L' 1**	**503N**	**20170320**	**C ZONE**	**-162**	**350**					**350**	**115**	**235**
17	34L 10	502AK	20170227	C ZONE	-166	82					82	73	9
18	34S0.1	503BU	20160929	C ZONE		93					93		n/a
19	34U 8	513D	20170315	C ZONE	-150	120	-165	320			320	119	201
20	34V3	503CB	20160527	C ZONE		245					245		n/a
21	34X40	513R	20170320	C ZONE	-85	40	-101	661			661	54	607
22	35F 20	513L	20170315	C ZONE	-70	340	-78	450	-85	120	450	478	-28
23	**35K1**	**523D**	**20170314**	**C ZONE**	**-88**	**27**	**-98**	**44**			**44**	**394**	**-350**
24	SB1_6		20170309	C ZONE		73					73	82	-9
25	OCWD-BS14/1		20170412	C ZONE		217					217	217	0
26	OCWD-BS21/1		20170412	C ZONE		175					175	181	-6
29	33Q1	DP1									50	50	n/a
30	33S1	DP2									50	50	n/a
31	33U3	DP3									50	50	n/a
32	33W	DP4									50	50	n/a
33	33X	DP5									50	50	n/a
34	33Y	DP6									50	50	n/a
35	33Z	DP7									50	50	n/a
36	34D	DP8									50	50	n/a
37	34E	DP9									50	50	n/a
38	34L	DP10									50	50	n/a
39	34V	DP11									50	50	n/a

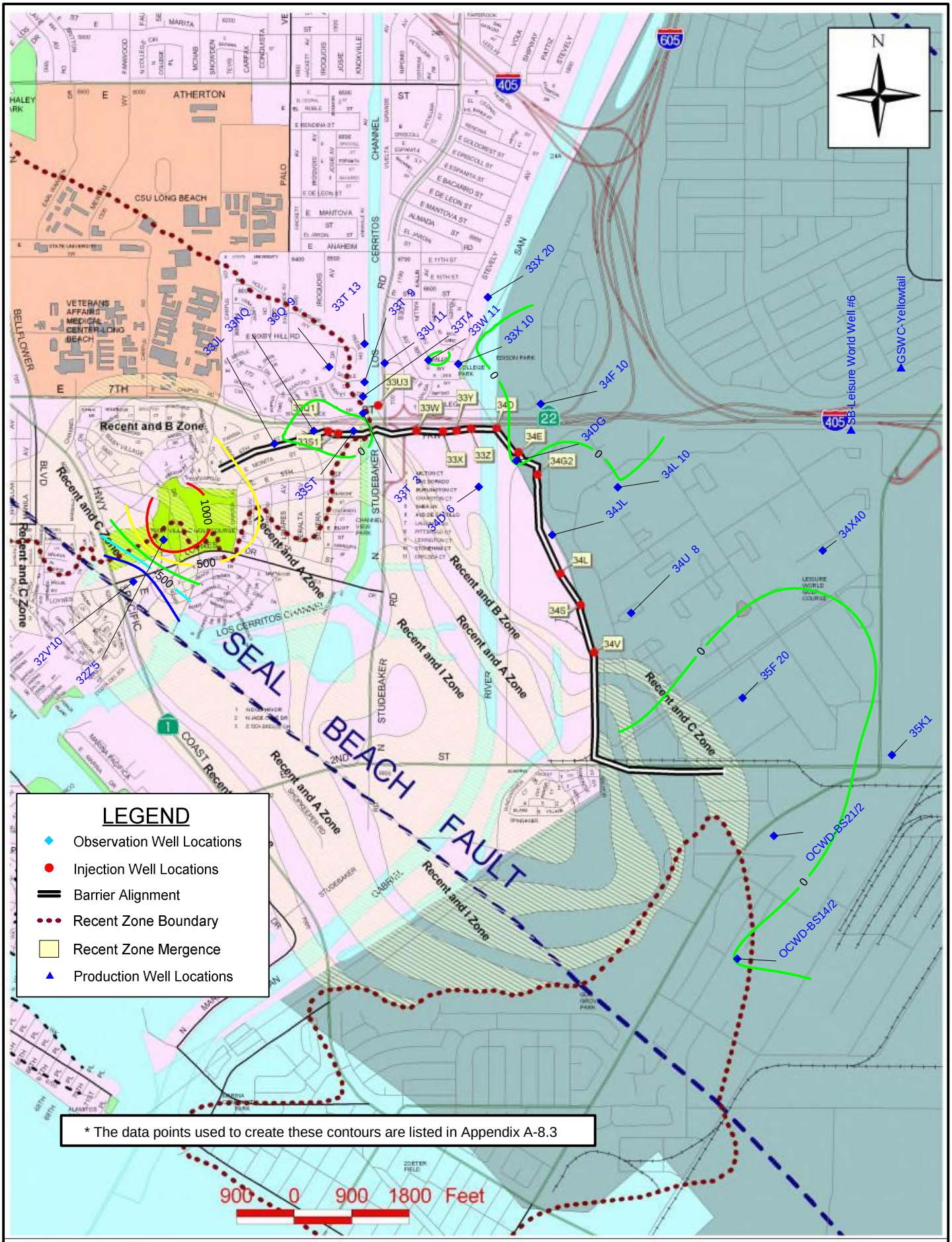
DP = Dummy Point with an assumed chloride concentration of 50 mg/L. Placed at wells that were injecting into this zone during this reporting period.



Alamitos Barrier Project
B Zone Chloride Concentration (mg/L) Contours: Spring 2017

A-8.1

B zone CL.srf



Alamitos Barrier Project
B Zone: Change in Chloride Concentration, Spring 2016 to Spring 2017

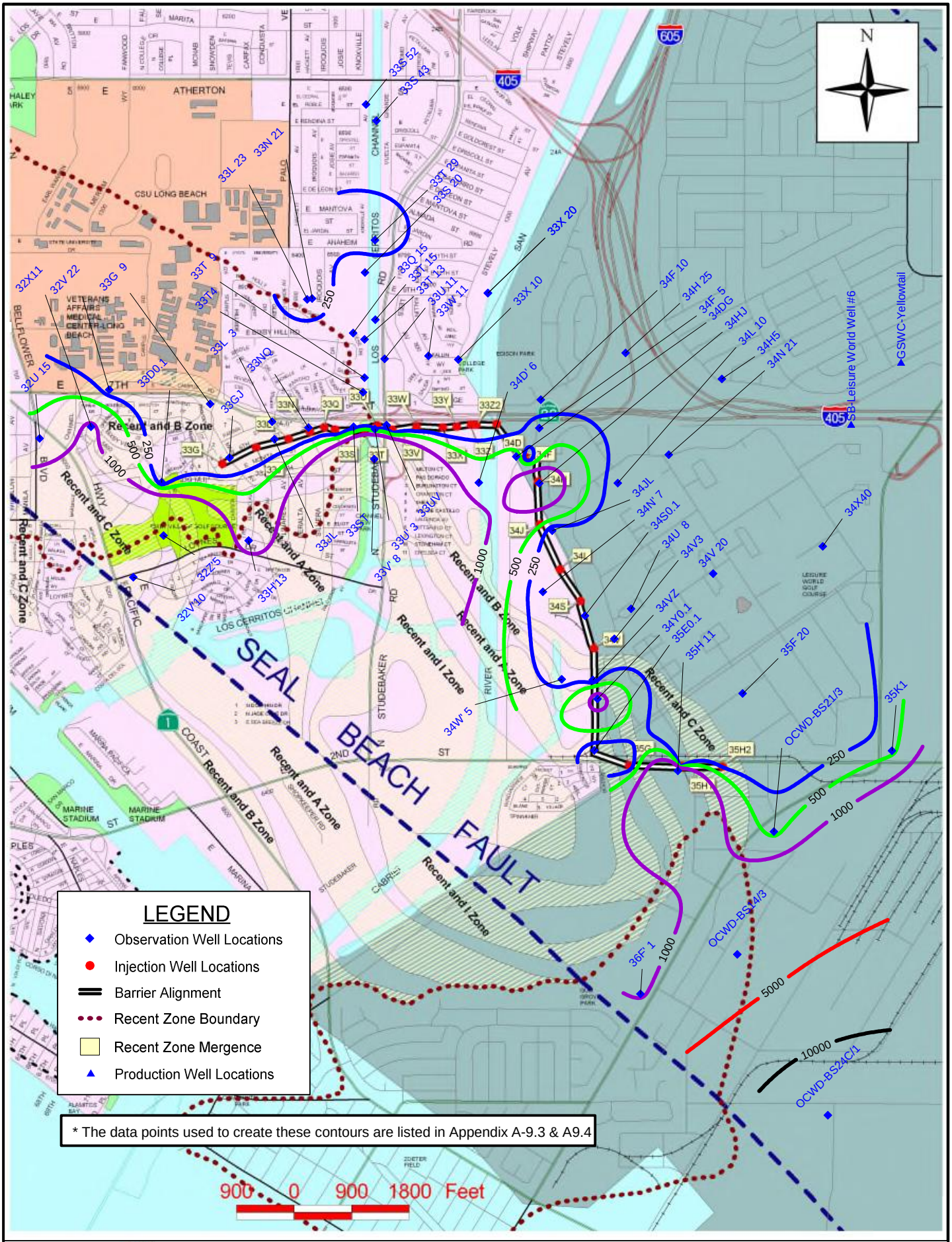
A-8.2

B zone CL.srf

ALAMITOS BARRIER PROJECT
B-ZONE CHLORIDE CONCENTRATIONS
Chloride Data Used for Contours and Cross-Section

No.	PROJ	FCD	DATE	AQUIFER	For Cross-Section (Internodal Wells in **Bold**)						For Contours	MAX CHLORIDE 15-16	Change in Chloride (FY16-17 - FY15-16)
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 16-17		
1	32V'10	483G	20170228	B ZONE	-62	2,400					2,400	4,400	-2,000
2	32Z'5	482W	20170313	(B,A)	-20	790	-30	1,300	-40	4,000	4,000	2,330	1,670
3	**33JL**	**492BQ**	**20170315**	**B ZONE**	**3**		**-7**	**87**			**87**	**79**	**8**
4	**33NQ**	**492BN**	**20170313**	**B ZONE**	**-3**	**52**	**-14**	**51**			**52**	**76**	**-24**
5	33Q 9	492CM	20170227	B ZONE	-85	110	-95	100	-105	100	110	90	20
6	33Q 15	492AN	20170301	B ZONE	-263	150					150		n/a
7	**33ST**	**492BK**	**20170314**	**(C,B)**	**-25**	**120**					**120**	**183**	**-63**
8	33T 3	492CL	20170228	B ZONE	-40	230	-57	210	-75	220	230	214	16
9	33T 9	492YY	20170320	B ZONE	-163	130					130	113	17
10	33T 13	492AB	20170316	B ZONE	-254	268					268	195	73
11	33T4	492CS	20170320	B ZONE	-91	174					174	18	156
12	33U 11	492AK	20170320	B ZONE	-260	309					309	59	250
13	33W 11	502S	20170316	B ZONE	-241	124	-269	131			131	139	-8
14	33X 10	502BC	20170302	B ZONE	-275	70					70	64	6
15	33X 20	502K	20170321	B ZONE	-266	75					75	67	8
16	34D' 6	502BG	20170306	B ZONE	-180	320	-194	320			320	84	236
17	**34DG**	**502Y**	**20170321**	**B ZONE**	**-232**	**80**	**-257**	**72**			**80**	**100**	**-20**
18	34F 10	502AQ	20170322	B ZONE	-269	68					68	71	-3
19	**34JL**	**503AQ**	**20170328**	**B ZONE**	**-196**	**1,080**	**-211**	**1,290**			**1,290**	**954**	**336**
20	34HJ	502BB	20160812	B ZONE		66					66		n/a
21	34L 10	502AL	20170227	B ZONE	-224	72	-249	82			82	79	3
22	34U 8	513E	20170315	B ZONE	-225	2,000					2,000	1,660	340
23	34V3	503CC	20160527	B		4,400					4,400		n/a
24	34X40	513Q	20170320	B ZONE	-137	59					59	24	35
25	35F 20	513K	20170315	B ZONE	-115	110					110	366	-256
26	**35K1**	**523A**	**20170314**	**B ZONE**	**-127**	**140**	**-142**	**150**	**-157**	**200**	**200**	**139**	**61**
27	OCWD-BS14/2		20170412	B ZONE		41					41	35	6
28	OCWD-BS21/2		20170412	B ZONE		331					331	376	-45
33	33Q1	DP1									50	50	n/a
34	33S1	DP2									50	50	n/a
33	33U3	DP3									50	50	n/a
34	33W	DP4									50	50	n/a
33	33X	DP5									50	50	n/a
34	33Y	DP6									50	50	n/a
35	33Z	DP7									50	50	n/a
36	34D	DP8									50	50	n/a
37	34E	DP9									50	50	n/a
38	34L	DP10									50	50	n/a
39	34V	DP11									50	50	n/a

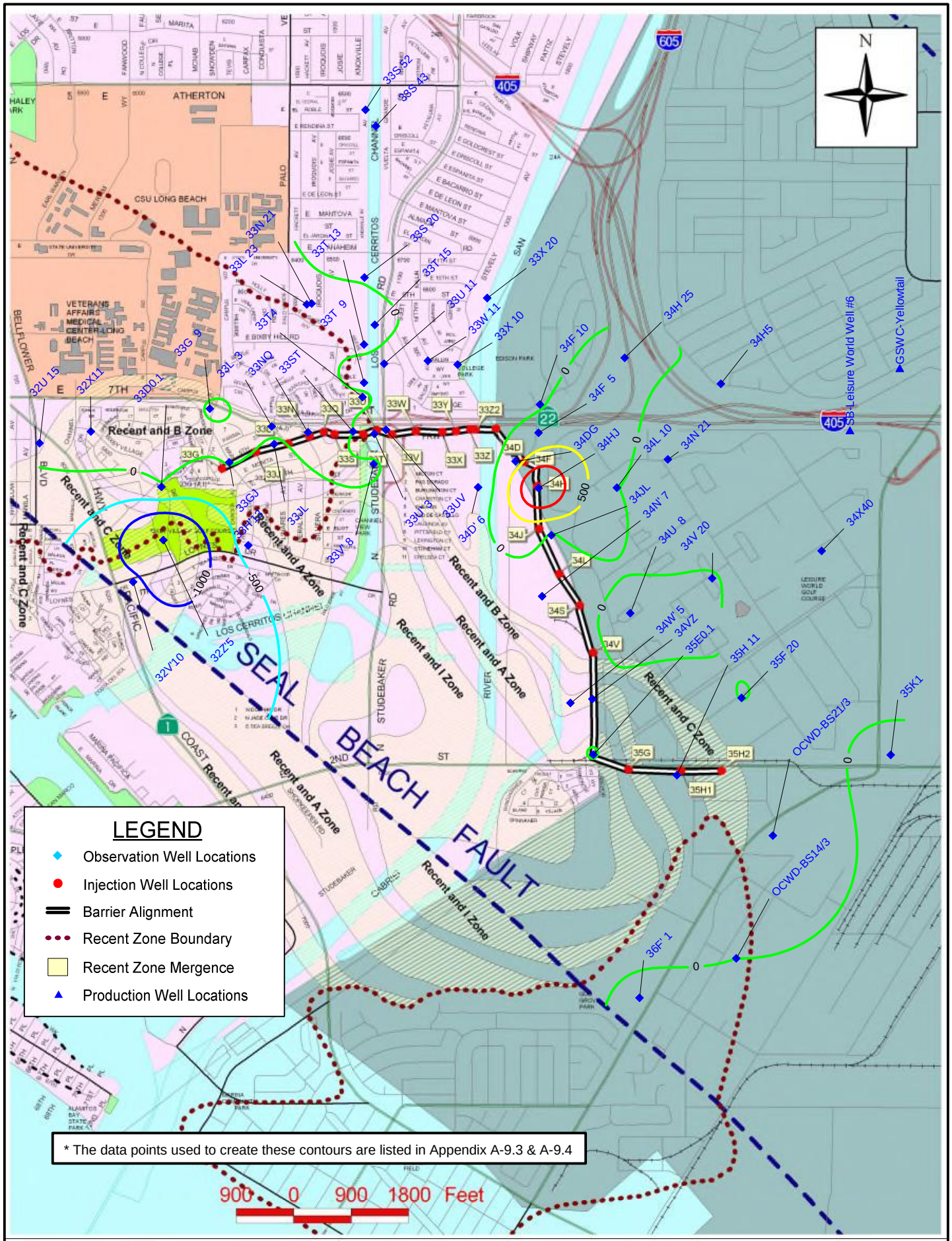
DP = Dummy Point with an assumed chloride concentration of 50 mg/L. Placed at wells that were injecting into this zone during this reporting period.



Alamitos Barrier Project
A Zone Chloride Concentration (mg/L) Contours: Spring 2017

A-9.1

A zone CL.srf



Alamitos Barrier Project
A Zone: Change in Chloride Concentration, Spring 2016 to Spring 2017

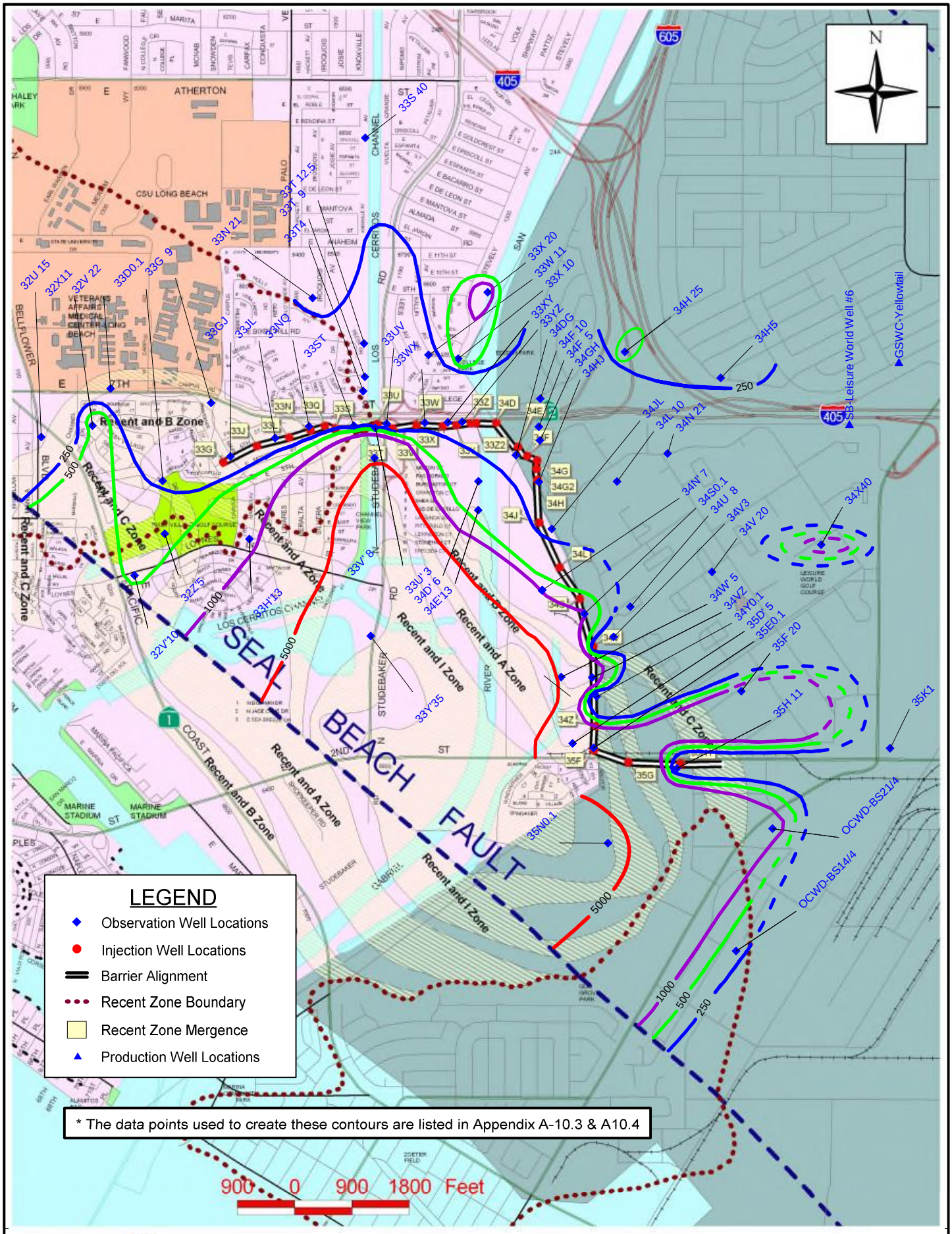
ALAMITOS BARRIER PROJECT
A-ZONE CHLORIDE CONCENTRATIONS
Chloride Data Used for Contours and Cross-Section

No.	PROJ	FCD	DATE	AQUIFER	For Cross-Section (Internodal Wells in **Bold**)						For Contours	MAX CHLORIDE 15-16	Change in Chloride (FY16-17 - FY15-16)
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 16-17		
1	32U 15	482M	20170309	A ZONE	-17	550					550	438	112
2	32V 22	482P	20170221	A ZONE	-11	140					140		n/a
3	32V'10	483F	20170228	A ZONE	-90	2,700	-105	2,900			2,900	3,720	-820
4	32X11	482S	20170315	A ZONE	-9	250	-24	1,100			1,100	710	390
5	33D0.1	482U	20170315	(A,I)	-24	97	-49	99	-74	100	100	131	-31
6	33G 9	482F	20170221	A ZONE	-3	79	-23	60			79	108	-29
7	**33GJ**	**482X**	**20170313**	**A ZONE**	**-35**	**120**					**120**	**102**	**18**
8	33H'13	493YY	20170221	(R,A)	-18	620	-38	620	-58	610	620	929	-309
9	**33JL**	**492BW**	**20170315**	**(A,I)**	**-41**	**85**	**-79**	**94**	**-116**	**92**	**94**	**107**	**-13**
10	33L 3	492	20170308	A ZONE	-60	82					82	62	20
11	33L 23	492RR	20170308	A ZONE	-344	380					380	363	17
12	33N 21	492BU	20170227	A ZONE	-305	350	-330	340	-346	18	350	329	21
13	**33NQ**	**492BP**	**20170313**	**(A,I)**	**-48**	**130**	**-92**	**100**	**-136**	**83**	**130**	**106**	**24**
14	33Q 15	492AM	20170301	A ZONE	-337	150					150		n/a
15	33S 20	492BR	20170222	A ZONE	-317	110	-336	89	-355	97	110	117	-7
16	33S 43	491E	20170223	A ZONE	-333	90	-344	89			90	453	-363
17	33S 52	491H	20170222	A ZONE	-284	220	-289	220			220	227	-7
18	**33ST**	**492BL**	**20170314**	**A ZONE**	**-65**	**88**	**-86**	**100**	**-100**	**89**	**100**	**95**	**5**
19	33T 9	492TT	20170316	A ZONE	-262	92					92	256	-164
20	33T 13	492ZZ	20170316	A ZONE	-128	228					228	172	56
21	33T 15	492SS	20170301	A ZONE	-334	130					130	105	25
22	33T 29	491C	20170223	A ZONE	-350	360					360		n/a
23	33T4	492CR	20170320	A ZONE	-146	232	-166	127	-186	91	232	117	115
24	33U 11	492AJ	20170320	A ZONE	-348	174					174	242	-68
25	33U' 3	492WW	20170223	A ZONE	-89	300					300	666	-366
26	**33UV**	**492BH**	**20170320**	**A ZONE**	**-106**	**102**	**-131**	**124**	**-155**	**117**	**124**	**337**	**-213**
27	33V' 8	492BY	20170307	(R,A)	-24	5,100	-48	3,200			5,100	5,040	60
28	33W 11	502T	20170316	A ZONE	-321	84	-349	93	-376	82	93	133	-40
29	33X 10	502BD	20170302	A ZONE	-320	88	-340	84	-356	80	88	107	-19
30	33X 20	502J	20170321	A ZONE	-353	110					110	120	-10
31	34D' 6	502BH	20170306	A ZONE	-270	620	-303	630	-335	630	630	1,050	-420
32	**34DG**	**502Z**	**20170321**	**A ZONE**	**-292**	**501**	**-324**	**696**			**696**	**433**	**263**
33	34F 5	502BR	20170322	A ZONE	-297	69	-322	81	-347	399	399	262	137
34	34F 10	502AR	20170322	A ZONE	-311	74	-326	75			75	100	-25
35	34H 25	502AH	20170322	A ZONE	-297	86	-312	86	-331	74	86	59	27
36	34H5	512E	20170322	A ZONE	-298	72	-313	74	-328	73	74	76	-2
37	**34HJ**	**502BX**	**20170316**	**A ZONE**	**-310**	**234**	**-321**	**544**	**-331**	**1,930**	**1,930**	**81**	**1,849**
38	**34JL**	**503AP**	**20170328**	**A ZONE**	**-263**	**65**	**-288**	**67**	**-308**	**108**	**108**	**175**	**-67**
39	34L 10	502AM	20170227	A ZONE	-310	94	-330	92	-354	88	94	82	12
40	34N 21	512B	20170301	A ZONE	-328	61	-354	57			61	220	-159

ALAMITOS BARRIER PROJECT
A-ZONE CHLORIDE CONCENTRATIONS
Chloride Data Used for Contours and Cross-Section

No.	PROJ	FCD	DATE	AQUIFER	For Cross-Section (Internodal Wells in **Bold**)						For Contours	MAX CHLORIDE 15-16	Change in Chloride (FY16-17 - FY15-16)
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 16-17		
42	34N' 7	503AF	20170222	A ZONE	-106	81	-144				81	82	-1
43	34S0.1	503BV	20160928	A ZONE		89					89		n/a
44	34U 8	513F	20170315	A ZONE	-280	120	-310	120			120	91	29
45	34V3	503CD	20160526	A		67					67		n/a
46	34V 20	513B	20170323	A ZONE	-234	79	-265	94	-292	91	94	76	19
47	**34VZ**	**503BH**	**20170323**	**A ZONE**	**-146**	**95**	**-156**	**93**			**95**	**97**	**-2**
48	34W' 5	503AJ	20170222	A ZONE	-81	74	-101	130	-119	83	130	220	-90
49	34X40	513P	20170320	A ZONE	-202	74	-232	144			144	430	-286
50	34Y0.1	503CL	20161107	A ZONE		1,320					1,320		n/a
51	35E0.1	503BK	20170315	A ZONE	-74	110					110	98	12
52	35F 20	513J	20170315	A ZONE	-129	86	-158	190			190	185	5
53	**35H 11**	**514G**	**20170314**	**A ZONE**	**-123**	**270**	**-146**	**3,400**			**3,400**	**3,720**	**-320**
54	**35K1**	**523B**	**20170314**	**A ZONE**	**-197**	**19**	**-212**	**350**	**-227**	**420**	**420**	**379**	**41**
55	36F' 1	505D	20170222	A ZONE	-99	810					810	779	31
56	OCWD-BS14/3		20170412	A ZONE		2,190					2,190	2,190	0
57	OCWD-BS21/3		20170412	A ZONE		398					398	484	-86
58	OCWD-BS24C/1		20170413	A ZONE		14,800					14,800		n/a
60	33G	DP1									50	50	n/a
61	33J	DP2									50	50	n/a
62	33L	DP3									50	50	n/a
63	33N	DP4									50	50	n/a
64	33Q	DP5									50	50	n/a
65	33S	DP6									50	50	n/a
66	33U	DP7									50	50	n/a
67	33V	DP8									50	50	n/a
68	33W	DP9									50	50	n/a
69	33X	DP10									50	50	n/a
70	33Y	DP11									50	50	n/a
71	33Z	DP12									50	50	n/a
72	33Z2	DP13									50	50	n/a
73	34D	DP14									50	50	n/a
74	34F	DP15									50	50	n/a
75	34L	DP16									50	50	n/a
76	34V	DP17									50	50	n/a
77	35G	DP18									50	50	n/a
78	35H1	DP19									50	50	n/a
79	35H2	DP20									50	50	n/a

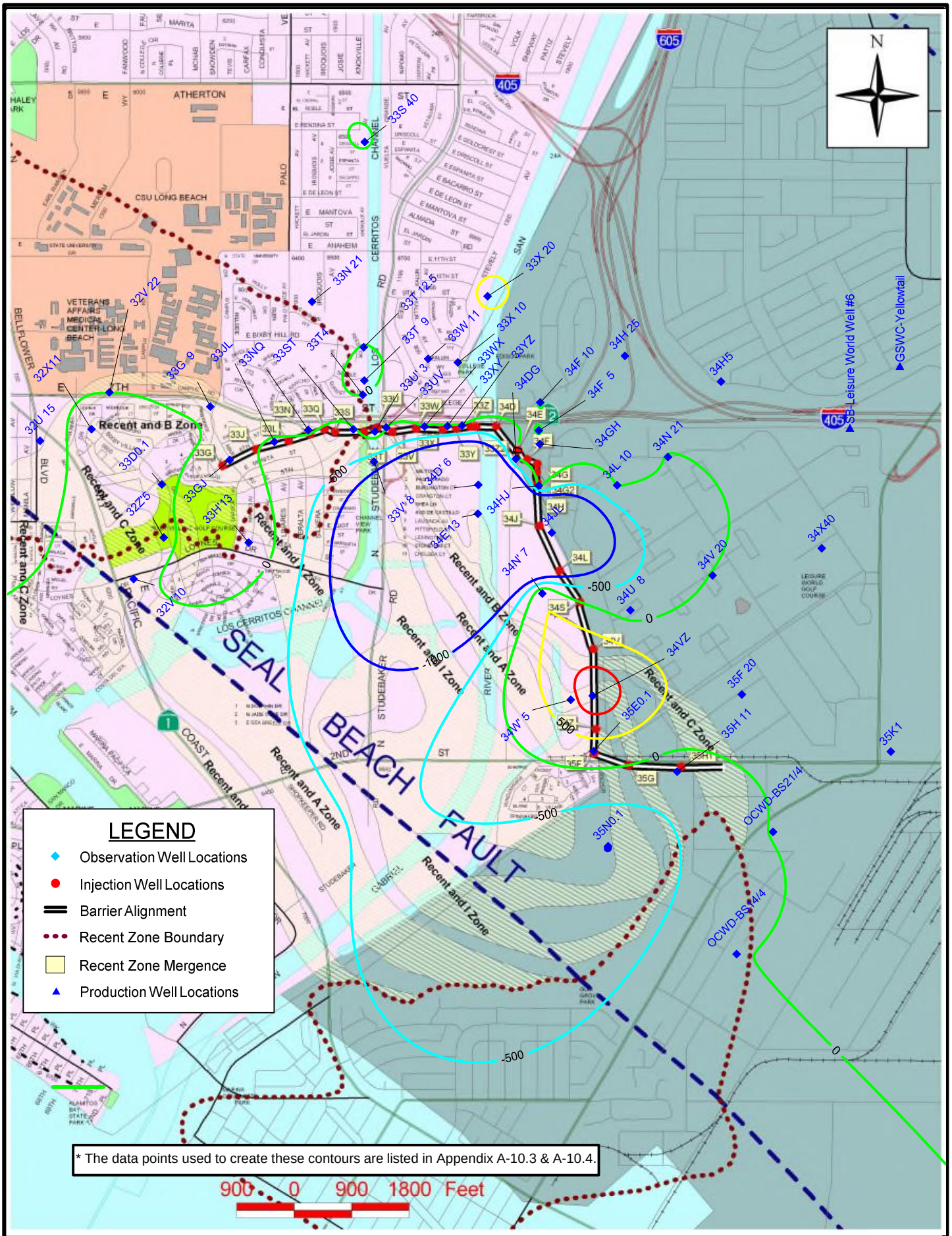
DP = Dummy Point with an assumed chloride concentration of 50 mg/L. Placed at wells that were injecting into this zone during this reporting period.



Alamitos Barrier Project
I Zone Chloride Concentration (mg/L) Contours: Spring 2017

A-10.1

I zone CL.srf



Alamitos Barrier Project
I Zone: Change in Chloride Concentration, Spring 2016 to Spring 2017

A-10.2

I zone CL.srf

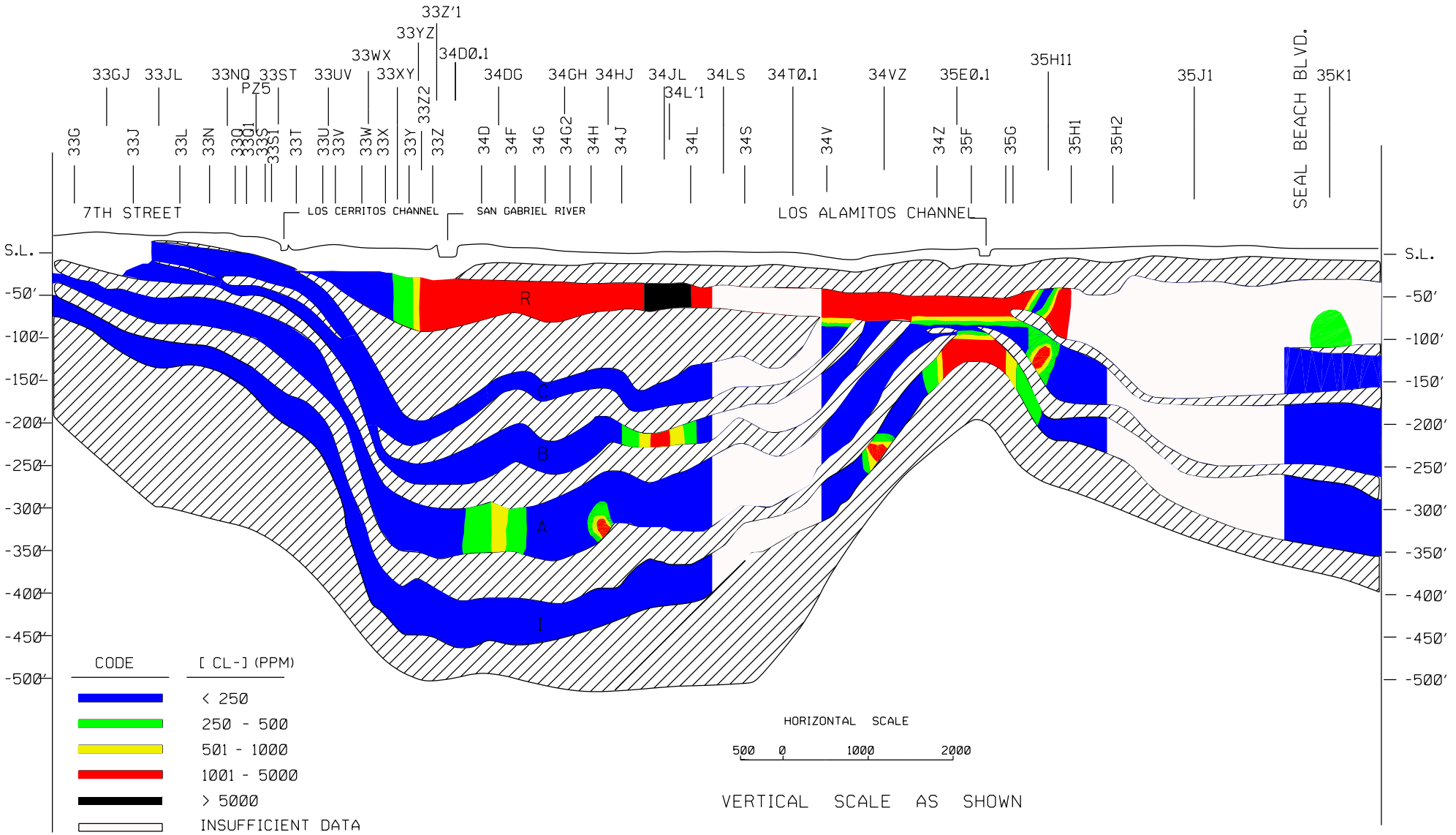
ALAMITOS BARRIER PROJECT
I-ZONE CHLORIDE CONCENTRATIONS
Chloride Data Used for Contours and Cross-Section

No.	PROJ	FCD	DATE	AQUIFER	For Cross-Section (Internodal Wells in **Bold**)						For Contours	MAX CHLORIDE FY15-16	Change in Chloride (FY16-17 - FY15-16)
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 16-17		
1	32U 15	482L	20170309	I ZONE	-74	160					160	81	79
2	32V 22	482N	20170221	I ZONE	-51	140					140	138	2
3	32V'10	483E	20170227	I ZONE	-140	380	-152	390	-165	370	390	401	-11
4	32X11	482R	20170314	I ZONE	-51	440	-61	540			540	614	-74
5	32Z'5	482V	20170313	I ZONE	-68	350	-83	480	-98	480	480	546	-66
6	33D0.1	482U	20170315	(A,I)	-24	97	-49	99	-74	100	100	131	-31
7	33G 9	482G	20170221	I ZONE	-34	83	-68	70	-78	76	83	72	11
8	**33GJ**	**482Y**	**20170313**	**I ZONE**	**-75**	**98**	**-95**	**100**			**100**	**93**	**7**
9	33H'13	493XX	20170221	I ZONE	-89	620					620	227	393
10	**33JL**	**492BW**	**20170315**	**(A,I)**	**-41**	**85**	**-79**	**94**	**-116**	**92**	**94**	**107**	**-13**
11	33N 21	492BV	20170227	I ZONE	-457	360	-468	340			360	68	292
12	**33NQ**	**492BP**	**20170313**	**(A,I)**	**-48**	**130**	**-92**	**100**	**-136**	**83**	**130**	**106**	**24**
13	33S 40	491F	20170222	I ZONE	-470	370					370	389	-19
14	**33ST**	**492BM**	**20170314**	**I ZONE**	**-130**	**80**	**-148**	**76**	**-163**	**75**	**80**	**108**	**-28**
15	33T 9	492XX	20170316	I ZONE	-364	86					86	161	-75
16	33T 12.5	492BT	20170228	I ZONE	-423	110	-438	98	-443	100	110	124	-14
17	33T4	492CQ	20170320	I ZONE	-277	119	-292	100			119	121	-2
18	33U' 3	492QQ	20170223	I ZONE	-147	300					300	102	198
19	**33UV**	**492BJ**	**20170320**	**I ZONE**	**-209**	**84**	**-228**	**83**	**-246**	**85**	**85**	**93**	**-8**
20	33V' 8	492BX	20170307	I ZONE	-109	4,100	-130	4,200			4,200	4,910	-710
21	33W 11	502U	20170316	I ZONE	-423	97	-446	111	-468	109	111	82	29
22	**33WX**	**502AG**	**20170323**	**I ZONE**	**-374**	**21**	**-391**	**78**	**-405**	**72**	**78**	**86**	**-8**
23	33X 10	502BE	20170302	I ZONE	-420	790	-440	530	-460	220	790	522	268
24	33X 20	502H	20170321	I ZONE	-442	2,850					2,850	2,300	550
25	**33XY**	**502BP**	**20170301**	**I ZONE**	**-404**		**-417**	**78**	**-431**	**78**	**78**	**89**	**-11**
26	33Y'35	493ZZ	20170223	I ZONE	-67	8,800					8,800		n/a
27	**33YZ**	**502AE**	**20170321**	**I ZONE**	**-402**	**83**	**-433**	**70**			**83**	**100**	**-16**
28	34D' 6	502BI	20170306	I ZONE	-400	330	-410	320	-418	330	330	5,460	-5,130
29	**34DG**	**502AA**	**20170321**	**I ZONE**	**-402**	**80**	**-432**	**79**			**80**	**87**	**-7**
30	34E'13	503AT	20170306	I ZONE	-289	350	-308	400			400	6,460	-6,060
31	34F 5	502BQ	20170322	I ZONE	-411	58	-426	58	-441	58	58	72	-13
32	34F 10	502AS	20170322	I ZONE	-416	64	-442	78			78	90	-12
33	**34GH**	**502BV**	**20170322**	**I ZONE**	**-412**	**88**	**-427**	**86**	**-437**	**85**	**88**	**78**	**9**
34	34H 25	502AJ	20170322	I ZONE	-407	564	-427	578	-446	604	604	528	76
35	34H5	512D	20170322	I ZONE	-408	142	-423	142	-443	335	335	253	82
36	**34HJ**	**502BW**	**20170316**	**I ZONE**	**-407**	**96**	**-417**	**88**	**-427**	**141**	**141**	**91**	**50**
37	**34JL**	**503AN**	**20170328**	**I ZONE**	**-383**	**117**	**-403**	**107**			**117**	**4,500**	**-4,383**

ALAMITOS BARRIER PROJECT
I-ZONE CHLORIDE CONCENTRATIONS
Chloride Data Used for Contours and Cross-Section

No.	PROJ	FCD	DATE	AQUIFER	For Cross-Section (Internodal Wells in **Bold**)						For Contours	MAX CHLORIDE FY15-16	Change in Chloride (FY16-17 - FY15-16)
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 16-17		
38	34L 10	502AN	20170227	I ZONE	-404	86	-426	91			91	74	17
39	34N 21	512C	20170301	I ZONE	-423	58	-448	55			58	71	-13
40	34N' 7	503AG	20170222	I ZONE	-221	120	-254	690	-274	640	690	211	479
41	34S0.1	503BW	20160927	I ZONE		1,060					1,060		1,060
42	34U 8	513G	20170315	I ZONE	-360	140	-375	130			140	355	-215
43	34V3	503CE	20160525	I ZONE		89					89		89
44	34V 20	513C	20170323	I ZONE	-386	46					46	31	14
45	**34VZ**	**503BG**	**20170323**	**I ZONE**	**-214**	**86**	**-224**	**4,010**			**4,010**	**2,560**	**1,450**
46	34W' 5	503AK	20170222	I ZONE	-156	4,900					4,900	4,090	810
47	34X40	513N	20170320	I ZONE	-331	1,840	-346	1,860			1,860	1,780	80
48	34Y0.1	503CN	20161108	I ZONE		287					287		287
49	35D' 5	503AM	20170222	I ZONE	-89	2,600					2,600		2,600
51	**35E0.1**	**503BJ**	**20170315**	**I ZONE**	**-114**	**4,500**					**4,500**	**4,240**	**260**
52	35F 20	513H	20170315	I ZONE	-235	2,500	-245	3,200	-255	3,600	3,600	3,300	300
53	**35H 11**	**514H**	**20170314**	**I ZONE**	**-203**	**190**					**190**	**460**	**-270**
54	**35K1**	**523C**	**20170314**	**I ZONE**	**-363**	**38**	**-373**	**36**			**38**	**26**	**13**
55	35N0.1	504N	20170301	I ZONE	-71	6,200					6,200	7,220	-1,020
56	OCWD-BS14/4		20170412	I ZONE		258					258	273	n/a
57	OCWD-BS21/4		20170412	I ZONE		1,270					1,270	1,250	n/a
58	33G	DP1									50	50	n/a
59	33J	DP2									50	50	n/a
60	33L	DP3									50	50	n/a
61	33N	DP4									50	50	n/a
62	33Q	DP5									50	50	n/a
63	33U	DP6									50	50	n/a
64	33V	DP7									50	50	n/a
65	33W	DP8									50	50	n/a
66	33X	DP9									50	50	n/a
67	33Y	DP10									50	50	n/a
68	33Z	DP11									50	50	n/a
69	33Z2	DP12									50	50	n/a
70	34D	DP13									50	50	n/a
71	34E	DP14									50	50	n/a
72	34F	DP15									50	50	n/a
73	34G2	DP16									50	50	n/a
74	34H	DP17									50	50	n/a
75	34L	DP18									50	50	n/a
76	34V	DP19									50	50	n/a

DP = Dummy Point with an assumed chloride concentration of 50 mg/L. Placed at wells that were injecting into this zone during this reporting period.



CHLORIDE SECTION ALONG THE BARRIER

Spring 2017

Note: The data points used to create this cross section are listed in the Appendix A-6.3, 7.3, 8.3, 9.3, 9.4, 10.3, & 10.4

ALAMITOS BARRIER PROJECT
Overview Map

N

POINT A
POINT B
POINT C
POINT D
Leo J. Vander Lans Water Treatment Facility

E WARDLOW RD
E SPRING ST
E WILLOW ST
E ATHERTON ST
E 7TH ST
E 2ND ST
N BELLFLOWER BLVD
N LOS COYOTES DIAG
N STUDEBAKER RD
E PACIFIC COAST HWY
LONG BEACH

33W110 33Y64 33X54 33W54 33Y42 33X20 33Z13 34H25 34H5 33Z11 33Y10 33X10 33W11 33U11 33T15 33S18 33T12.5 33Q9 33T9 33U3 33Q1 33S 33U 33X 33Y 33Z 34D 34F10 34E 34F5 34F 34G 34GH 34G2 34DC 34D'6 34H 34L10 34J 34JL 34L 34E'13 34F'13 34E'23 34X40 34V20 34N21 34N'7 34LS 34S 34U8 34T0.1 34V 34VZ 34W'5 34Z 35F20 35F 35G 35H1 35H2 35H12 35H11 35J1 35K1 35V6 35N'15 35N0.1 36F'1 36F'14 35S'24 35T'24 35V'32 36W'80 34Q'22 34S'16 34S'22P 34H'38 34Q'15 34J'12 34N'16 34V'18 34H'17P 34H'18P 33Y'35 33U'34 33D'22 32T'25 33V'46 33K'42 32X'35 32Y'43 33Z'50 33Z'52 34F'40 33K'47 33T'24 33V'22 33V'15P 33H'13 PZ1 32Z'5 32L'8 32V'10 33D0.1 32X'3 PZ2 33S1 33V'14 33T'13 33T'8 33W'17 33V'8 33W'14 33Z2 33T 33V 33W 33L 33J 33G 33N 33Q 32S9 32U15 32X11 32V22 33G9 33D24 33H57 33L55 32Y63 33G36 33L30 33L23 33N21 33S52 33S43 33S40 33T29 33S20 33L77 33L90 33G86 33L

Rossmoor
Los Alamitos
Leisure World
Alamitos Heights
Park Estates
Belmont Park

0 1,200 2,400 4,800
Feet

A-12.1

Legend

- Alamitos_Injection_Well
- Observation Well
- ABP Water Supply Line

ALAMITOS BARRIER PROJECT

Project Location Map

N

POINT A

POINT B

POINT C

POINT D

E WARDLOW RD

E SPRING ST

E WILLOW ST

E ATHERTON ST

E 7TH ST

E 2ND ST

N BELLFLOWER BLVD

N LOS COYOTES DIAG

N STUDEBAKER RD

E PACIFIC COAST HWY

LONG BEACH

Leo J. Vander Lans Water Treatment Facility

ABP Telemetry System Upgrade - Replacement of existing Geomation hardware with Siemens-based telemetry equipment, and integration into the Seawater Barrier Telemetry System.

ABP Unit 14 - Barrier Improvement Project. Construction of 17 new injection wells and 4 nested monitoring wells between wells 34HJ and 35F. Two injection wells and one nested monitoring well are proposed between Points B and C.

ABP Monitoring Well Destruction: Destruction of selected poor-condition monitoring wells that have exceeded thier useful life.

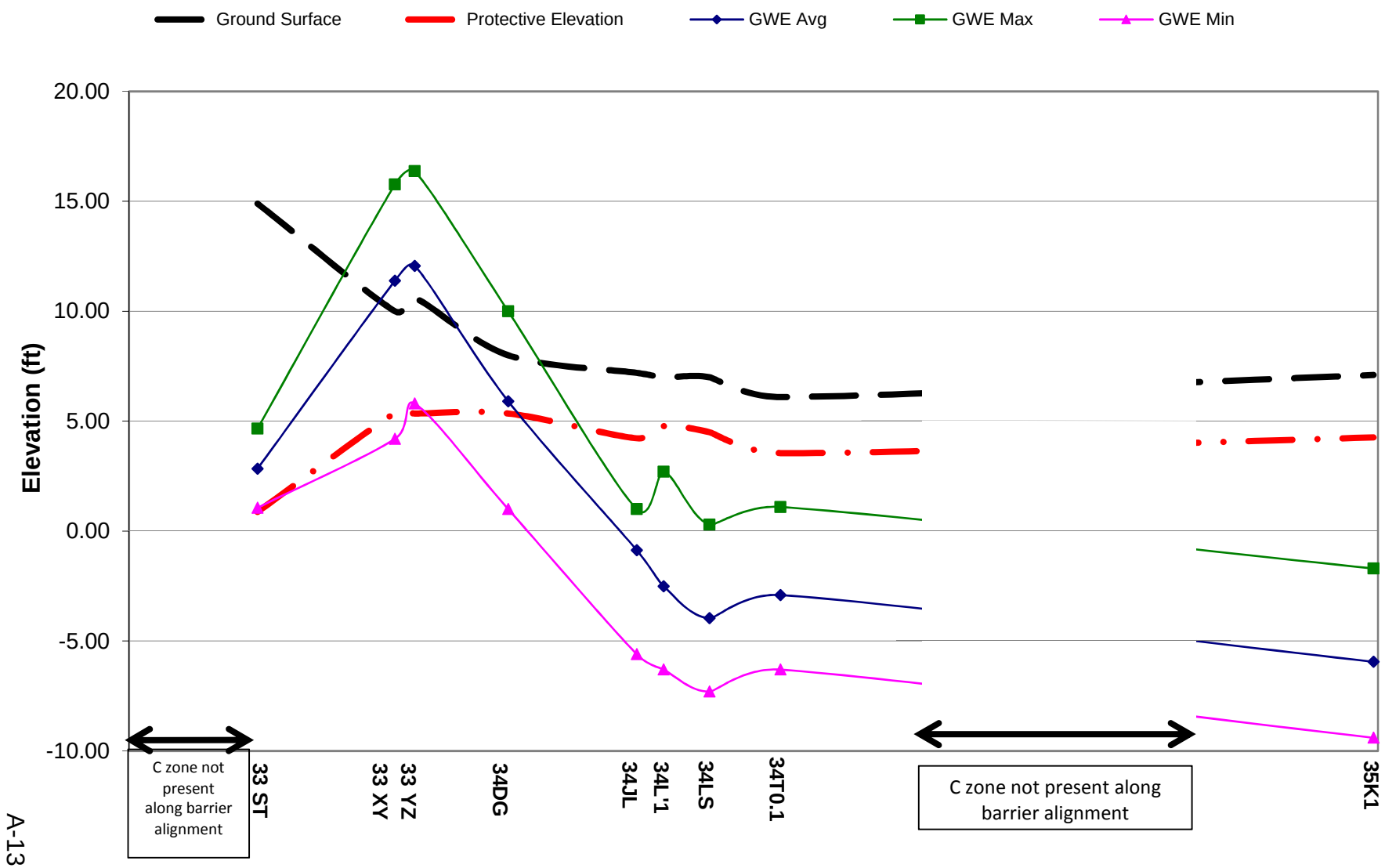
0 1,200 2,400 4,800 Feet

A-12.2

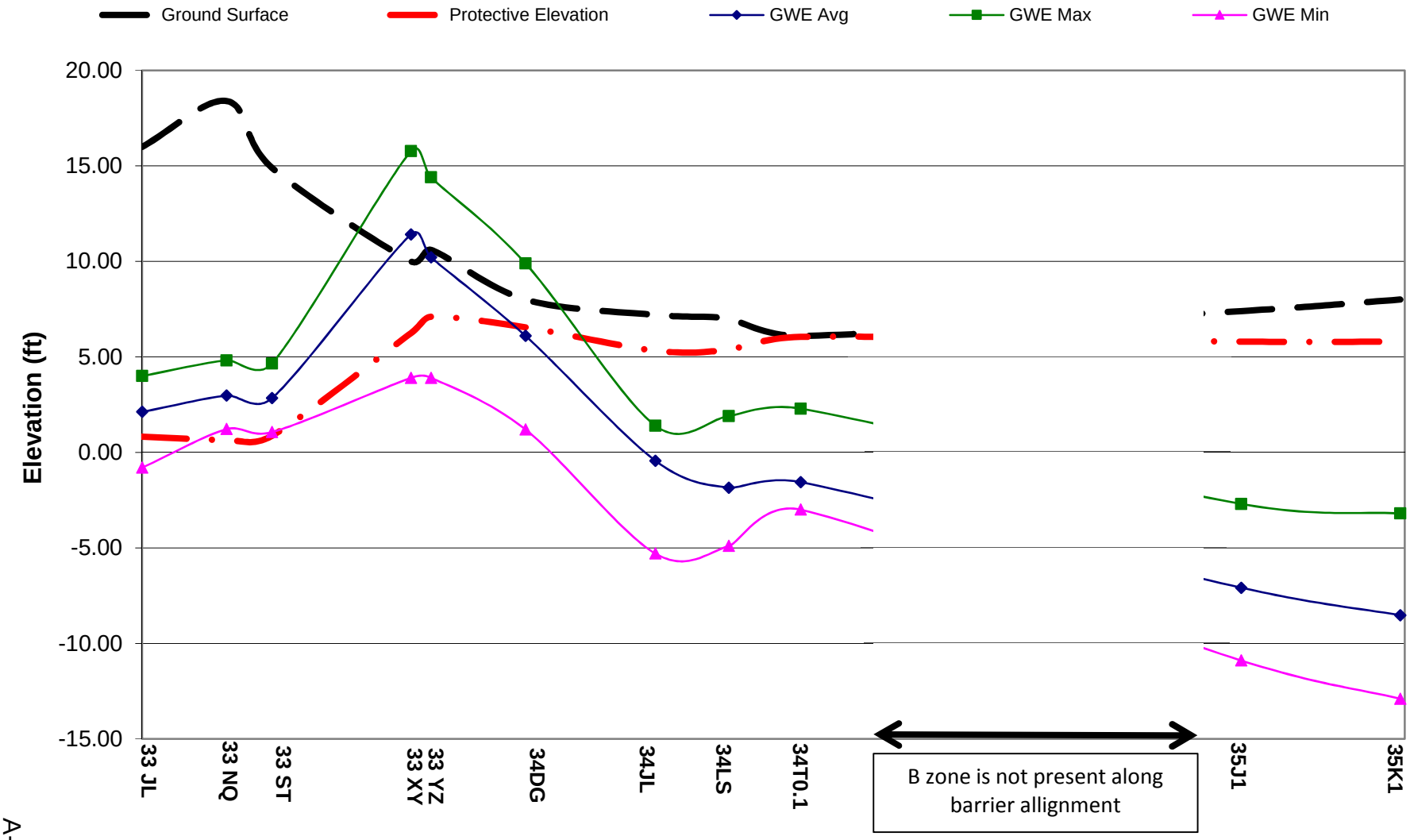
Legend

- Alamitos_Injection_Well
- Observation Well
- ABP Water Supply Line

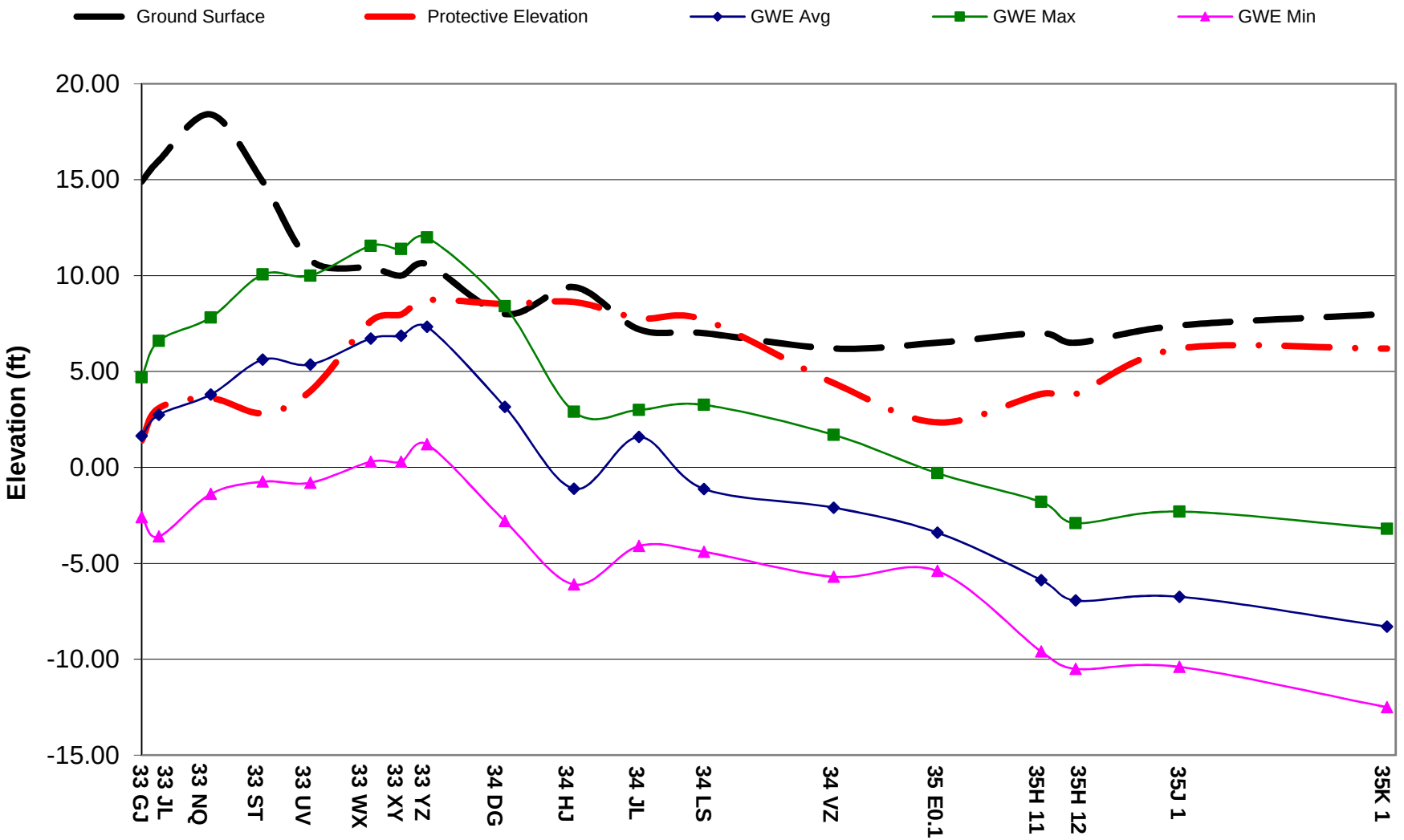
C Zone - Groundwater Elevation (GWE) Along the ABP FY 16-17



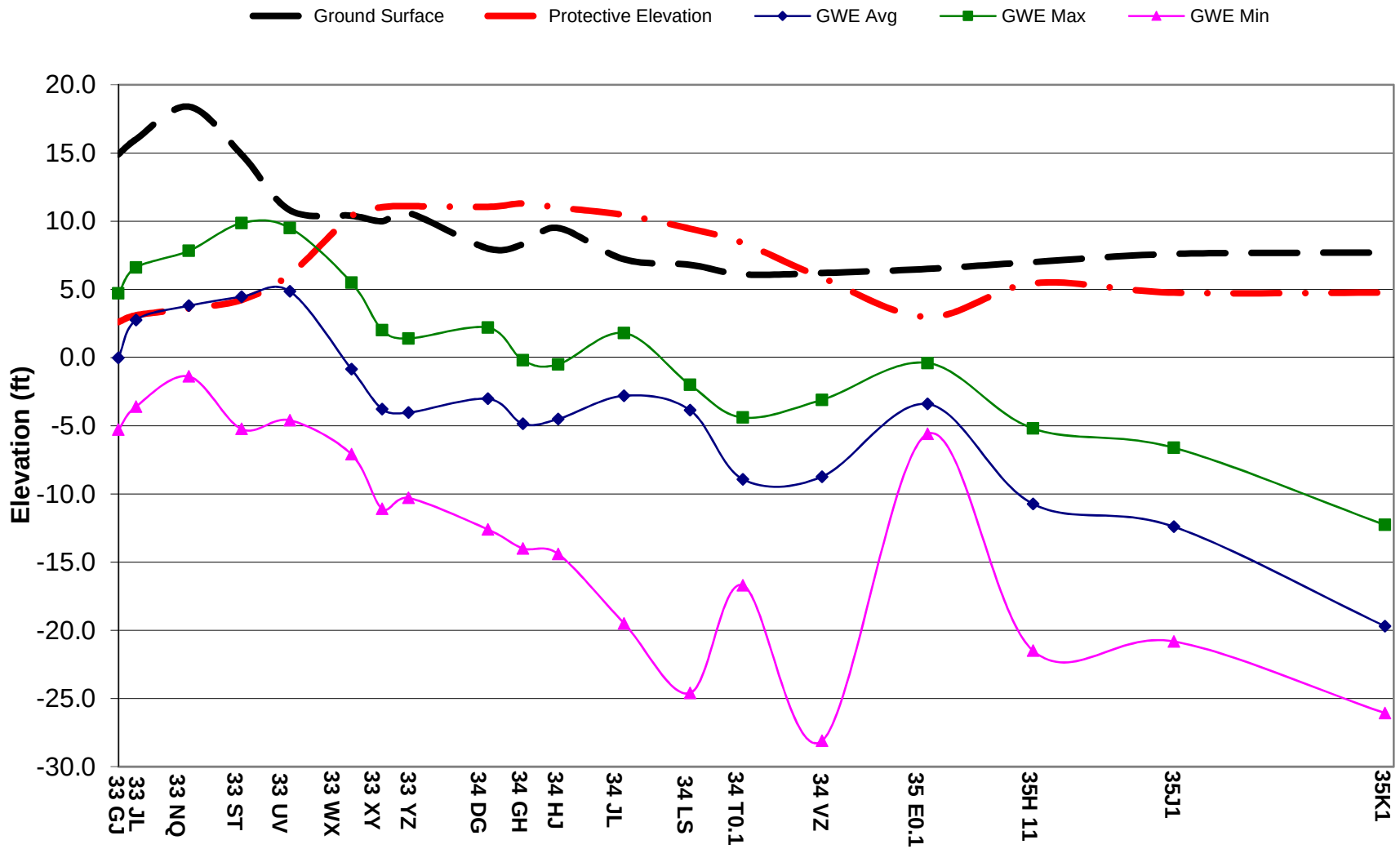
B Zone - Groundwater Elevation (GWE) Along the ABP FY 16-17



A Zone - Groundwater Elevation (GWE) Along the ABP FY 16-17



I Zone - Groundwater Elevation (GWE) Along the ABP FY 16-17



Current Capital Improvement Projects and Contracts (July 2016 through June 2017)

Board Award Date	Project Title	Description	Contractor	Final Contract Amount	Field Acceptance
June-2016	ABP Telemetry Upgrade	Replace existing Geomation system with Siemens based system, also incorporate signal from well 33U3	Leed Electric, Inc.	$388,308 Awarded	Fall 2017 [Estimated]
Oct-2015	ABP Unit 14 - Phase 1 Drilling of injection and observation wells	Construction of 17 new clustered injection wells (8 locations), 4 nested observation wells, and 2 shallow piezometers	Jensen Drilling Co.	$9,984,335 Awarded	Summer 2017
May-2017	ABP Unit 14 - Phase 2 Wellhead improvement	Installation of injeciton well vaults, piping, and telemetry equipment	Kiewit	$3,550,000 Awarded	Fall 2018 [Estimated]

Note: For a full history of improvement projects and contracts on record, please contact LACDPW.

Summary of the Alamitos Barrier Project Shutdowns (July 2016 through June 2017)

Shutdown	Startup	Duration (days)	Impacted Portion of ABP	Reason	Addressed By	Means of Repair/Remediation
5/15/2014	N/A	N/A	Well 34H(A)	Overpressure, will not take water.	LACDPW	Well is filled with sediment due to hole near top of perforations. Well to be abandoned
9/5/2014	N/A	N/A	Well 33S1(C,B)	Surface leakage	LACDPW	Injection resumed with limited flowrate
8/1/2016	4/7/2017	249	34G2(C,B)	Requested shutdown to aide OCWD drilling project	LACDPW	Injection was restored
10/10/2016	N/A	N/A	34S(C,B) 34S(A) 34S(I)	Requested shutdown to aide OCWD drilling project	LACDPW	Well remained offline
9/1/2016	4/7/2017	218	34J(A&I)	Requested shutdown to aide OCWD drilling project	LACDPW	Injection was restored
4/7/2017	N/A	N/A	34V(C,B) 34V(A) 34V(I)	Requested shutdown to aide OCWD drilling project	LACDPW	Well remained offline

Notes:

* Routine and/or minor shutdowns of individual wells are not listed here but are included in Figure 3 of the Annual JMC Report and Table 2 for the Semi-Annual Meeting.

ABP EXPENDITURES
FY 16-17

ITEM NO.	DESCRIPTION	JOB NO.	DESCRIPTION	SERVICES AND SUPPLIES	FY 2016-17 BUDGET	% BUDGET FY 16-17	OCWD SHARE 19%	OCWD BUDGET FY 16-17	% OCWD BUDGET FY 16-17	LADPW SHARE	LADPW BUDGET FY 16-17	% LADPW BUDGET FY 16-17
1.	Analysis and direc	H0321551	ABP ANALY&DIR OF INJECTION O	33,265.96								
	of injection opera	H0321550	BARRIER PROJECT OPERATION-GEN	50,822.76								
			Subtotal #1	**84,088.72**	85,000	98.9%	**16,145.03**	29,750	54.3%	67,943.68	55,250	123.0%
2.	Maintenance and re	F6004011	MAINT INJECTION WELLS - ABP	175,947.40								
	of injection wells	F5064011	INJECT. WELLS-MAINTAIN(ALAMITO	56,984.58								
		H0321911	Alamitos Barrier Proj-Telemetry Maint.	62,194.28								
		F6900000F	MAINT ENGR - BARRIER PROJ	11,992.50								
		HF01511000	DGBP Automated System	15,190.88								
		F5009760F	DRILL EQPT-MAINT&TEST - Eaton Yard	42,132.50								
			Subtotal #2	**364,342.14**	450,000	81.0%	**69,953.69**	157,500	44.4%	294,388.45	292,500	100.6%
3.	Operation of injec	F6004000	RECHARGE OPER U/S - ABP	47,498.99								
			Subtotal #3	**47,498.99**	40,000	118.7%	**9,119.81**	14,000	65.1%	38,379.18	26,000	147.6%
4.	Analysis and direc	H0321555	ABP ANALY&DIR OF EXTRACT OPE	0.00								
	of extraction operations (No cost to OCWD)		Subtotal #4	**0.00**	0	N/A	**0.00**	0	0.0	0.00	-	-
5.	Maintenance, and repair of											
			Subtotal #5	**0.00**	10,000	0.0%	**0.00**	0	0.0	0.00	10,000	0.0%
6.	Operation of extra wells (No cost to OCWD)	F6000090	ABP ANALY&DIR OF EXTRACT OPE	1,509.72								
			Subtotal #6	**1,509.72**	6,000	25.2%	**0.00**	0	0.0	1,509.72	6,000	25.2%
7.	Maintenance and re	H0321569	ALAMITOS BARRIER PROJECT	159,873.07								
	of distribution sy	F6004010	MAINT AIR/VAC-BLWOFF U/S - ABP	6,364.84								
		F6004012	MAINT PRS - ABP	40,155.08								
		F6004014F	ABP Locate & Mark Barrier Proj. U/grd. L	19,870.36								
		H0321016	Seawater Barriers Administrative Support	32,432.05								
		F6001907	INSPECT CRANE PRES REDUCE - ABP	1,536.01								
		F6009118	Disassemble/Reassemble of Wells ABP	17,074.64								
			Subtotal #7	**277,306.05**	350,000	79.2%	**53,242.76**	122,500	43.5%	224,063.28	227,500	98.5%
8.	Maintenance of observation wells	F6005270	POST EMERGENT WEED CONTROL	114.13								
		F6005273	POST EMERGENT WEED CONTROL	1,195.85								
			Subtotal #8	**1,309.98**	70,000	1.9%	**251.52**	24,500	1.0%	1,058.47	45,500	2.3%
9.	Collection of groundwater data	H0321552	ABP COLL OF GR WTR DATA FOR	175,992.37								
			City of Seal Beach Permit #DPW03161	690.00								
			City of Seal Beach Permit #DPW03308	439.24								
			OCPW Permit No 2017-00018	669.50								
			Subtotal #9	**177,791.11**	200,000	88.9%	**34,135.89**	70,000	48.8%	143,655.22	130,000	110.5%
10.	Yard Maintenance	FFM34107	Facility Maintenance Alamitos Yd F107	52,391.27								
		FPM34107OS	Planned Maint. Alamitos Yd F107-OSD	751.25								
		F6060580	Alamitos Yard Remodel	11,562.49								
		F6001904	CONDUCT QUARTERLY INSPECTION	327.94								
		F6001920	CONDUCT QUARTERLY INSPECTION	275.44								
		F6003123	BUILDING MAINTENANCE NONRESI	4,027.81								
		F6003124	BUILDING MAITENANCE-NONRESI	3,816.69								
	(Flat Fee from OCWD)		Subtotal #10	**73,152.88**	80,000	91.4%	**4,634.97**	4,620	100.3%	68,517.92	75,380	90.9%
11.	Well redevelopment	F5064022	Redevelop injections wells - ABP	72,165.39								
		F55430538	REDEVELOP INJECTION WELL 33Z2 - A. B. P.	21,348.30								
		F55662234	REDEVELOP INJECTION WELL 34S1 - A.B.P.	12,610.81								
		F55689143	REDEVELOP INJECTION WELL 33Q1 - A.B.P.	29,433.39								
		F55701711	REDEVELOP INJECTION WELL 33N - A.B.P.	22,601.32								
		F55701713	REDEVELOP INJECTION WELL 33J - A.B.P.	18,861.71								
		F55703407	REDEVELOP INJECTION WELL 33G - A.B.P.	26,363.48								
		F55715295	REDEVELOP INJECTION WELL 33L - A.B.P.	19,158.69								
		F55768556	REPAIR INJECTION WELL 33Z - WCBP	19,927.23								
		F55805116	REDEVELOP INJECTION WELL 35F - A.B.P.	21,885.78								
		F55805121	REDEVELOP INJECTION WELL 34Z - A.B.P.	17,665.75								
		F55815807	REDEVELOP INJECTION WELL 35G - A.B.P.	19,785.58								
		F55815810	REDEVELOP INJECTION WELL 34F, A ZONE - A	13,855.32								
		F55815813	REDEVELOP INJECTION WELL 34F, I ZONE -	11,722.50								
		F55826970	REDEVELOP INJECTION WELL 34E, I ZONE - A	23,713.16								
		F55826972	REDEVELOP INJECTION WELL 34E, C, B ZONE	20,397.43								
		F55826975	REDEVELOP INJECTION WELL 34H, I ZONE - A	15,214.92								
		F55834698	REDEVELOP INJECTION WELL 34L - A.B.P.	6,491.45								
		H0321554	ABP WELL REDEVELOPMENT PROGRAM	67,502.09								
		H0321565	ABP NPDES MONI & REPORT INJ WE	36,925.37								
			OCPW permit #2017-00019	1,545.00								
			Subtotal #11	**499,174.67**	1,000,000	49.9%	**95,841.54**	140,000	68.5%	403,333.13	260,000	155.1%
12.	Processing of data and preparation of reports	H0321553	ABP DATA PRO & PRE OF REPORT	57,636.38								
			Subtotal #12	**57,636.38**	60,000	96.1%	**11,066.18**	21,000	52.7%	46,570.20	45,500	102.4%
13.	Special Programs (No cost to OCWD unless pre-arrange	HF01515000	ALAMITOS BARRIER MONITORING WELL DESTRUC	57,615.70								
		H0321591	ALAMITOS BARRIER PROJ-PLANNING	2528.85								
		X5009468	BUDGETING FOR R&R OF SEAWATER INTRUSION	2234.45								
		EF02610112	Alamitos Barrier Project Unit 13 Observa	958.97								
		EF02616001	Alamitos Barrier Project Unit 14 Improve	738,805.34								
			Subtotal #13	**802,143.31**	50,000	1604.3%	**0.00**	0	0.0	802,143.31	50,000.00	1604.3%
14.	Reclaim Water Prog	H0321556	ABP RECLAIMED WATER SUPPLY	44,137.92								
			Subtotal #14	**44,137.92**	30,000	147.1%	**8,474.48**	10,500	80.7%	35,663.44	19,500	182.9%
15.	Projects & Studies (Reimbursable amounts include labor expenses, plus approved	HF01515001	ALAMITOS BARRIER PROJECT TELEMETRY SYSTE	213,565.92								
			Subtotal #15	**213,565.92**	10,000	2135.7%	**4,555.60**	3,500	130.2%	209,010.32	6,500	3215.5%
16.	ABP Liability Insur	N/A	ABP General Liability Coverage	58,144.94								
	Premiums paid separately by OCWD		ABP Excess Liability Coverage	17,442.86								
			Subtotal #16	**75,587.80**	75,000	100.8%	**37,793.90**	37,500	100.8%	37,793.90	37,500	100.8%
			TOTAL	**2,719,245.59**	**2,516,000.00**	108.1%	**345,215.37**	**635,370.00**	93.0	2,374,030.22	2,376,500	53.3

NOTES:
1 OCWD share represents 19.2% of the total costs in all Items except for 4, 5, 6, 10, 13, and 16. The percentage is based on amount of overall barrier injection water provided to Orange County portion of the ABP during this fiscal year.
2 Per Agreement No. 8458 between the LACFCD and the OCWD, all costs included in Items 4, 5, 6 and 13 are not reimburseable with respect to OCWD.
3 Per Agreement No. 8458 between the LACFCD and the OCWD, the cost of liability insurance shall be split equally among the Parties.

TOTAL OPERATION AND MAINTENANCE COST (not including insurance premium)	$ 2,643,657.79
ORANGE COUNTY'S SHARE OF THE OPERATION AND MAINTENANCE COST (not including insurance premium)	$ 307,421.47
Less: Los Angeles County's Share of the FY16-17 Liability Insurance	$ 37,793.90
Less: Permit fees paid by OCWD	$ 3,343.74
Less: Advance Deposit Paid by OCWD (50% of the OCWD FY16-17 budget)	$ 298,935.00
BALANCE DUE FROM ORANGE COUNTY WATER DISTRICT	**$ (32,651.17)**

ABP FY18-19 Budget

JMC No.	Fiscal Year	LACFCD		OCWD		WRD		TOTAL	
		Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual
1.		Analysis and direction of injection operation ($)							
	2014-15	48,750	62,054	26,250	28,453			75,000	90,507
	2015-16	48,750	74,291	26,250	40,355			75,000	114,646
	2016-17	55,250	67,944	29,750	16,145			85,000	84,089
	2017-18	65,000		35,000				100,000	
	2018-19	*65,000*		*35,000*				*100,000*	
2.		Maintenance and repair of injection wells ($)							
	2014-15	260,000	304,809	140,000	139,764			400,000	444,573
	2015-16	260,000	290,273	140,000	157,679			400,000	447,952
	2016-17	292,500	294,809	157,500	70,054			450,000	364,863
	2017-18	292,500		157,500				450,000	
	2018-19	*292,500*		*157,500*				*450,000*	
3.		Operations of Injection Well Facilities ($)							
	2014-15	22,750	24,537	12,250	11,251			35,000	35,787
	2015-16	19,500	34,922	10,500	18,970			30,000	53,892
	2016-17	26,000	38,379	14,000	9,120			40,000	47,499
	2017-18	32,500		17,500				50,000	
	2018-19	*32,500*		*17,500*				*50,000*	
4.		Analysis and direction of extraction operation ($)							
	2014-15	0	693					0	693
	2015-16	0	632	0	0			0	632
	2016-17	0	0	0	0			0	0
	2017-18	0		0				0	
	2018-19	*0*		*0*				*0*	
5.		Redevelopment, maintenance, and repair of extraction wells ($)							
	2014-15	200,000	8,764					200,000	8,764
	2015-16	15,000	3,683	0	0			15,000	3,683
	2016-17	10,000	0	0	0			10,000	0
	2017-18	10,000		0				10,000	
	2018-19	*10,000*		*0*				*10,000*	
6.		Operations of Extraction Wells ($)							
	2014-15	5,200	4,257					5,200	4,257
	2015-16	6,000	2,647	0	0			6,000	2,647
	2016-17	6,000	1,510	0	0			6,000	1,510
	2017-18	5,000		0				5,000	
	2018-19	*5,000*		*0*				*5,000*	
7.		Maintenance and repair of ABP ($)							
	2014-15	195,000	226,415	105,000	103,818			300,000	330,232
	2015-16	195,000	172,875	105,000	93,907			300,000	266,782
	2016-17	227,500	224,063	122,500	53,243			350,000	277,306
	2017-18	227,500		122,500				350,000	
	2018-19	*195,000*		*105,000*				*300,000*	
8.		Maintenance of Observation Wells ($)							
	2014-15	32,500	49,901	17,500	22,881			50,000	72,783
	2015-16	195,000	3,065	105,000	1,665			300,000	4,730
	2016-17	45,500	1,058	24,500	252			70,000	1,310
	2017-18	130,000		70,000				200,000	
	2018-19	*32,500*		*17,500*				*50,000*	
9.		Collection of groundwater data ($)							
	2014-15	97,500	134,811	52,500	61,815			150,000	196,625
	2015-16	110,500	103,842	59,500	56,408			170,000	160,250
	2016-17	130,000	143,655	70,000	34,136			200,000	177,791
	2017-18	130,000		70,000				200,000	
	2018-19	*130,000*		*70,000*				*200,000*	
10.		Yard Maintenance ($)							
	2014-15	53,500	54,199	6,500	375			60,000	54,574
	2015-16	75,380	61,078	4,620	8,027			80,000	69,105
	2016-17	75,380	68,518	4,620	4,635			80,000	73,153
	2017-18	70,760		9,240				80,000	
	2018-19	*66,250*		*8,750*				*75,000*	
11.		Injection Well Redevelopment ($)							
	2014-15	325,000	243,344	175,000	111,580			500,000	354,925
	2015-16	520,000	621,605	280,000	337,662			800,000	959,266
	2016-17	260,000	403,333	140,000	95,842			400,000	499,175
	2017-18	650,000		350,000				1,000,000	
	2018-19	*325,000*		*175,000*				*500,000*	
12.		Processing of data and preparation of reports ($)							
	2014-15	45,500	36,360	24,500	16,672			70,000	53,033
	2015-16	45,500	30,846	24,500	16,756			70,000	47,602
	2016-17	39,000	46,570	21,000	11,066			60,000	57,636
	2017-18	39,000		21,000				60,000	
	2018-19	*39,000*		*21,000*				*60,000*	
13.		Oversight of Reclaim Water Program ($)							
	2014-15	7,800	24,057	4,200	11,031			12,000	35,088
	2015-16	9,750	23,466	5,250	12,747			15,000	36,213
	2016-17	19,500	35,663	10,500	8,474			30,000	44,138
	2017-18	29,250		15,750				45,000	
	2018-19	*32,500*		*17,500*				*50,000*	
14.		Projects and Studies ($)							
	2014-15	45,500	6,854	24,500	3,143			70,000	9,996
	2015-16	45,500	50,025	24,500	27,174			70,000	77,199
	2016-17	6,500	19,171	3,500	4,556			10,000	23,727
	2017-18	6,500		3,500				10,000	
	2018-19	*6,500*		*3,500*				*10,000*	
15.		ABP Liability Insurance ($)							
	2014-15	37,500	35,955	37,500	35,955			75,000	71,910
	2015-16	37,500	37,794	37,500	37,794			75,000	75,589
	2016-17	37,500	37,794	37,500	37,794			75,000	75,588
	2017-18	38,000		38,000				76,000	
	2018-19	*38,000*		*38,000*				*76,000*	
16.		Total ABP Expenditure ($)							
	2014-15	1,376,500	1,217,010	625,700	546,738			2,002,200	1,763,747
	2015-16	1,583,380	1,511,042	822,620	809,145			2,406,000	2,320,187
	2016-17	1,230,630	1,382,469	635,370	345,315			1,866,000	1,727,784
	2017-18	1,726,010		909,990				2,636,000	
	2018-19	*1,269,750*		*666,250*				*1,936,000*	
TOTALS		Total ABP Operations and Maintenance ($) [Item 16-Item 15]							
	2014-15	1,376,500	1,181,055	588,200	510,783			2,002,200	1,691,838
	2015-16	1,545,880	1,473,248	785,120	771,350			2,331,000	2,244,599
	2016-17	1,193,130	1,344,675	597,870	307,521			1,791,000	1,652,196
	2017-18	1,688,010		871,990				2,560,000	
	2018-19	*1,231,750*		*628,250*				*1,860,000*	
		Volume of Water (ac-ft)							
	2014-15			2,275	2,236	4,225	4,877	6,500	7,113
	2015-16			2,275	2,399	4,225	4,409	6,500	6,808
	2016-17			2,450	1,165	4,550	4,895	7,000	6,060
	2017-18			2,450		4,550		7,000	
	2018-19			*2,960*		*4,440*		*7,400*	